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Royal Army Medical Corps

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EDITED BY

COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

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NOTICE.

CHARITY COMMISSION

In the matter of the Charity called or known as the ALEXANDER MEMORIAL FUND.

NOTICE IS HEREBY GIVEN that an Order has been made by the Charity Commissioners for England and Wales, establishing a Scheme for the regulation of the above mentioned Charity.

Copies of the Order and Scheme may be inspected during a period of one calendar month from the first publication of this Notice, at the Office of the Royal Army Medical College, Millbank, S.W.1, and at the Charity Commission, Ryder Street, St. James's, S.W.1, where copies may be purchased at the price of 1s. 3d. each.

J. E. C. ADAMS, Secretary.

VOL. LXIII JULY, 1934. No. 1.

Journal
of the
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Original Communications.

ANTI-TYPHOID INOCULATION.

Observations Relative to the Immunological Value of Different Cultures of "Bacterium typhosum."

BY BREVET-COLONEL H. MARRIAN PERRY, O.B.E., K.H.S.,
MAJOR H. T. FINDLAY
AND
MAJOR H. J. BENSTED, M.C.,
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WORK on the immunological value of different typhoid vaccines has been in progress in the Vaccine Department of the Royal Army Medical College for a considerable period and the results have been published in a series of recent communications (Perry, Findlay and Bensted, 1933 (*a*) and (*b*), 1934). During the course of these experiments it has become increasingly evident that the accepted view of the relation between certain properties of the organism and its value as an immunizing agent requires modification. This has been recognized by other workers (Topley, 1933). Although in the past, investigators (Leishman, 1905) were of the opinion that avirulent organisms were as effective as virulent organisms in the preparation of vaccines, the majority of present-day immunologists are agreed that there is a definite correlation between the efficiency of a vaccine and the virulence of the organism employed in its preparation. Reference will later be made to the recent investigations of Maltaner (1934).

It has been the custom, especially as regards the group of Gram-negative intestinal bacilli, to consider as virulent organisms possessing properties that connote "smoothness." There can be little doubt that, on occasions, the term "smoothness" has held a special meaning for some laboratory workers. Generally it indicated that the cultures yielded colonies having a glossy surface and a smooth regular outline; produced emulsions that were stable in saline; gave negative tests with Millon's reagent and were satisfactorily agglutinated by an "O" antiserum at 52° C. These properties were accepted as indicating virulence and such bacteria were regarded as suitable for the preparation of vaccine.

The determination of virulence by animal tests, employing mice as the experimental animals, which has formed an important part of our recent investigations on the subject, has compelled us to alter our views on the value of such criteria as an indication of virulence. In January, 1933, twelve recently isolated strains of typhoid bacilli, several of which had originated from the same outbreak, were examined relative to this property. When selected smooth cultures were injected intraperitoneally into mice it was found that their minimal lethal dose varied from 50 to 250 million organisms.

Felix (1934) has recently demonstrated that highly virulent cultures of this organism are resistant to agglutination by an "O" antiserum when the reaction is carried out at 37° C. and live emulsions are employed. The virulence of the organisms referred to above has remained unchanged and six of the strains have been examined on these lines. The results are shown in Table I.

It will be noted that the examination of these recently isolated strains has yielded results which confirm fully the findings of Felix with regard to stock laboratory strains.

The unreliability of "smooth" characters as an indication of virulence receives confirmatory evidence by our recent observations on the rejuvenation of the original Rawlings strain of *Bact. typhosum*. The virulence of this organism was so low that the minimal lethal dose was 500 to 600 million organisms. Its colonial characters were definitely rough and emulsions were unstable in low concentrations of saline. In addition, it gave a strongly positive test with Millon's reagent. Subsequent to animal passage, although emulsions were now salt stable and its virulence was so raised that mice were regularly killed by doses of 50 million organisms, the colonies were still suggestive of roughness and Millon's test remained positive. In spite of continued and rapid passage through mice the cultures did not lose completely these so-called rough characters even though their virulence was still further slightly raised.

Table II illustrates the characters of the three cultures—the original Rawlings, the rejuvenated Rawlings and the strain that had been subjected to continued and rapid mouse passage—together with strain "A," which has been inserted for comparison. This strain has been

TABLE I.

Strain.	Minimal lethal dose in millions of organisms.	Agglutination of live organisms with T.O. antiserum at 37°C.	Agglutination of killed organisms with T.O. antiserum at 52°C.
W.*	50.	(±)	+++
J.*	50.	(±)	+++
S*	50-100.	+	+++
G*	200.	+++	+++
C.	50.	(±)	+++
Mc.L.	50.	(±)	+++

* Cultures isolated from the same outbreak.

All virulence tests are carried out on eighteen hour broth cultures.

TABLE II.

Test.	Cultures of typhoid bacilli.			
	Strain 'A'.	Original rough Rawlings.	Rejuvenated Rawlings.	Rejuvd. Rawlings after continued rapid passage.
Colonial appearance.	Glossy surface, smooth regular outline.	Granular surface, irregular outline.	Suggestion of slightly granular surface.	Suggestion of slightly granular surface.
Stability in Saline.	Stable in 6·4%	Unstable in 0·4%	Stable in 6·4%	Stable in 6·4%
Stability in 10% serum-broth.	Stable.	Unstable.	Stable.	Stable.
Millon's test.	Negative.	Positive.	Slightly positive.	slightly positive.
Acriflavine test.	Negative.	Positive.	Positive.	Positive.
Agglutination of killed organisms with T.O. antiserum at 52°C.	+++	+	+++	+++
Agglutination of live organisms with T.O. antiserum at 37°C.	+++	+++	(±)	(±)
Minimal lethal dose for mice in millions of organisms.	100.	500–600.	50.	< 50.

maintained in the laboratory for a number of years and it has always exhibited to the fullest extent the classical properties of "smoothness."

The observations recorded in Table II on the results of applying the usually accepted tests for "smoothness" emphasize the fact that such tests do not indicate gradations in virulence which are of manifold importance in assessing the protective capacity of the culture.

In the comparative trials of the efficiency of different typhoid vaccines previously published (Grinnell, 1932; Perry, Findlay and Bensted, 1933 (*a*), 1934) the investigations were of a qualitative nature. It was desirable to ascertain if this protection could be estimated quantitatively. The following experiment was, therefore, devised to compare the degree of protection conferred by different cultures. Four vaccines were used in the observation and the cultures employed were strain "A," original Rawlings, rejuvenated Rawlings, and the rejuvenated strain after it had been subjected to continued and rapid passage through mice. The emulsions were prepared from saline washings of twenty-four hour growths on agar. In the case of the last-named vaccine the emulsion was made directly from mouse-heart-blood culture on agar. The vaccines were all standardized to contain 500 million organisms and were sterilized by means of heat and phenol.

As a preliminary, a series of ranging tests was undertaken by inoculating mice intraperitoneally with 50 and 100 million organisms of the different vaccines at six-day intervals. On the tenth day following the last injection the test doses of live organisms were inoculated into the peritoneal cavity. They consisted of 2, 5 and 10 M.L.D. and were prepared from an eighteen-hour broth culture of the Watson strain of the typhoid bacillus. This broth culture was concentrated by centrifugalization and was then standardized by accurate dilution and matching with an opacity tube representing 1,000 million organisms per c.c. The dose was adjusted in each case so that it was contained in 0·5 c.c. The ranging tests showed that these cultures possessed the following protective capacity:—

Strain "A" protected against 2 to 5 M.L.D. of the test organisms.

Original Rawlings protected against <1 M.L.D. of the test organisms.

Rejuvenated Rawlings protected against 5 to 10 M.L.D. of the test organisms.

Further passaged strain, protected against 10 M.L.D. of the test organisms.

These observations were then repeated, using 100 mice divided into batches of ten each. The results are shown in Table III.

It will be noted that vaccines manufactured from the "smooth" strain "A" protect mice against approximately 3 M.L.D. of the test organism, whereas vaccines prepared from the highly virulent passaged strain protect these animals against 10 M.L.D. In order to obtain evidence that continued mouse passage had not altered the immunogenic value of the culture for animals of other species, as has been reported in the case of some of the viruses (Findlay, 1934), guinea-pigs were immunized with the same vaccines and their subsequent protection was estimated in the manner

indicated above. Results of the same order as those recorded for mice were obtained.

In view of the consonant results obtained previously (Perry, Findlay and Bensted, 1934) between bactericidal tests in human individuals and in mice and protection tests in mice, it appears justifiable to assume that vaccines prepared from highly virulent cultures will be as superior in human prophylaxis as they have been shown to be in the case of laboratory animals.

Discussion.

The fact that recently isolated strains of typhoid bacilli may vary within wide limits in their virulence and protective capacity is of considerable practical importance in the vaccine prophylaxis of typhoid fever. Protection tests have been undertaken on many occasions on mice following inoculation with vaccines made from organisms of varying virulence. The findings have been most consistent in furnishing proof that the more highly virulent the organism, the greater is its immunizing value.

Many workers engaged in the preparation of typhoid vaccines are content to use so-called standard strains; a few employ recently isolated strains on the assumption that their "smooth" characteristics, as judged by colonial appearance, salt stability, etc., are indicative of high virulence, and, therefore, of satisfactory protective efficiency. Whilst it is true that certain recently isolated strains may be highly virulent, it is evident that there may be a wide variation in both virulence and protective efficiency between such strains. The important factors in the selection of the culture to be used in the vaccine would appear to be the demonstration of its high virulence by animal test and the insensitivity of the living culture to agglutination by an "O" antiserum at 37° C. The recognition of the varying virulence of apparently true "smooth" cultures arrived at on the one hand by animal test, and on the other by the demonstration of the resistance of the living cultures to "O" agglutination, which were undertaken independently, are confirmatory of one another.

From the observations that have been made it is apparent that although a "smooth" and relatively avirulent organism may be superior to its "rough" prototype in immunizing property, its efficiency in this respect cannot be compared with that of a highly virulent typhoid bacillus. It has been shown that the strain of *Bact. typhosum* subjected to repeated and rapid animal passage affords a protection approximately four times greater than that given by the classically "smooth" strain of lower virulence. For this reason the Army typhoid-paratyphoid vaccine now includes, as its typhoid element, the highly virulent culture of the rejuvenated Rawlings strain. It has also become a routine procedure to estimate the virulence of the cultures prior to the manufacture of each batch of vaccine.

Mention must be made of a recent communication (Maltaner, 1934) in which it is concluded that vaccines prepared from "rough," and

TABLE III.

Quantitative Estimation of Protection in Mice

Mice immunized with 50 and 100 million organisms of their respective vaccines by intraperitoneal injections at six day intervals. Vaccines prepared from :-				
	Strain "A"	Original Rawlings.	Rejuvenated Rawlings.	Continued and rapid passage of rejuvenated Rawlings.
The test doses were administered ten days after the last injection of vaccine. They were prepared from an 18 hour broth culture of *Bacterium typhosum* by centrifugalization. The strength of the doses was governed by the results obtained from the preliminary ranging experiments.	100 mill. 2 M.L.D. 10/10 survived.	50 mill. 1 M.L.D. 6/10 survived.	300 mill. 6 M.L.D. 8/8 survived.	450 mill. 9 M.L.D. 10/10. survived.
	150 mill. 3 M.L.D. 8/9 survived.		400 mill. 8 M.L.D. 6/9 survived.	500 mill. 10 M.L.D. 9/9 survived.
	200 mill. 4 M.L.D. 2/10 survived.		500 mill. 10 M.L.D. 0/10 survived.	600 mill. 12 M.L.D. 4/10 survived.
Control animals.	0/10 survived following a dose of 50 millions (i.e. 1 M.L.D) of test organism.			

presumably avirulent, organisms induce a greater degree of protection in rabbits than that afforded by vaccines made from "smooth" bacilli. There are many points in the article open to serious criticism.

It is not proposed to analyze in any detail the communication, which was received when this paper was prepared for publication. It may, however, be mentioned that, owing to the method of immunizing the animals—eight to twelve intravenous injections at frequent intervals—the author fails to produce evidence that would permit a comparison to be made between the value of the two vaccines. This investigator appears to be unaware that a multiplicity of intravenous injections tends to exhaust the immunizing mechanism of the animal. Further, that it has been shown (Topley, 1933) that following five or six weekly injections the protective antibodies reach a maximum and any additional inoculations tend to lower this figure.

In immunological work it would be more satisfactory if the terms "smooth" and "rough," which are in such common usage, could be discarded and the property of the culture expressed in terms of virulence. Should further investigation show that these observations relative to the typhoid bacillus are applicable to other species of bacteria much confusion would be avoided and a more intelligible idea would be conveyed of the most important character of the organism.

The investigations we have made are not concerned with the explanation of the greater antigenic value of rapidly passaged strains of the typhoid bacillus. It would, however, appear that the exaltation of virulence of the organism and, therefore, of its protective capacity is reached in the animal body when the resistance is just broken down by the virulence of the bacillus. Further observations may show that this is dependent upon the presence of an antigen elaborated by the interaction of these processes. The fact that marked variation has been noted between the virulence of strains isolated from the same epidemic has a bearing on this point. In endemic areas of typhoid fever it should be possible to ascertain the correlation, if any, between the virulence of the organism isolated and the clinical type of the case. It is probable that bacilli recovered from fatal cases would have a higher virulence and protective capacity when used as a vaccine, than those derived from the milder type of case.

Summary.

(1) Animal test has shown that there may be a wide variation in virulence between recently isolated strains of typhoid bacilli derived from the same outbreak.

(2) Evidence is advanced of the unreliability of the use of the terms "smoothness" and "roughness" to indicate the degree of virulence of an organism.

(3) A method of quantitative estimation of the degree of protection induced in mice by different typhoid vaccines is described.

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WITH THE MALAKAND FORCE.

By Captain M. G. de L'ISLE STURM,
Royal Army Medical Corps.

The Chitral Road is guarded throughout its entire length from Chakdara to Dir by a series of small forts, sited at fairly frequent intervals and known as Levy Posts. These Levy Posts are manned by the Dir Levies, subjects of the Nawab of Dir, and protect the road which connects our outpost garrison of Chitral to British India. The Dir Levies, with their white uniforms picked out in scarlet and green, are an efficient if picturesque and irregular body of men, and carry out their work very satisfactorily.

Not infrequently there is trouble between the Levies and the neighbouring tribes, and early in February 1932, the Painda Khel, one of these tribes, attacked a Levy Post on the crest of the Laram Pass, drove away the occupants, and burnt the Fort. The Laram Pass forms an alternative route from Chakdara, the starting point of the Chitral Road, to Robat. It was thought at the time that this unrest might continue and endanger the security of our communications with Chitral, so a small body of troops was despatched to Chakdara, in order, according to the local Press, to create a "steadying influence." This column, known as the Malakand Force, consisted of a regiment of cavalry, a mountain battery, a cavalry signal troop, a cavalry field troop, two Indian infantry battalions, one of which comprised the Malakand garrison with its detachments at Dargai and Chakdara, a section of Armoured Cars, part of an Animal Transport Company, a Motor Transport section and a Medical Detachment. The Royal Air Force co-operated from Peshawar and Risalpur.

The first intimation I received regarding this affair was being called to the Medical Mobilization Stores in Peshawar one evening, having been cruelly uprooted from the Club, and being ordered to proceed next morning as S.M.O. Force, with a detachment of a Field Ambulance and requisite medical equipment, to Chakdara. We were to proceed in two motor ambulances and one 30-cwt. lorry.

It looked as if I should have to make bricks without straw. My detachment seemed very inadequate in numbers; one havildar and twelve ambulance sepoys being the entire strength to cater for the medical requirements of numerically a brigade. I was given no animal transport, but managed to "secure" this later on.

My orders were to report to the Force Commander at Malakand, so our small convoy set off from Peshawar next morning; a very dusty journey.

Arrived at Malakand, we were halted by an officer of the Gurkha Rifles, who informed me that my orders had been changed. . . . I had to proceed straight to Chakdara and report there.

At Chakdara I met Waters, a captain in the Indian Medical Service, who gave me a great deal of invaluable help before he returned to Malakand. Waters at that time was Senior Medical Officer, Malakand, and doing a great deal of good.

My men were allotted accommodation in the Fort, tents being pitched near the hospital. The motor ambulances were retained, but the 30-cwt. lorry was returned to Dargai, where an advanced supply depôt had been formed.

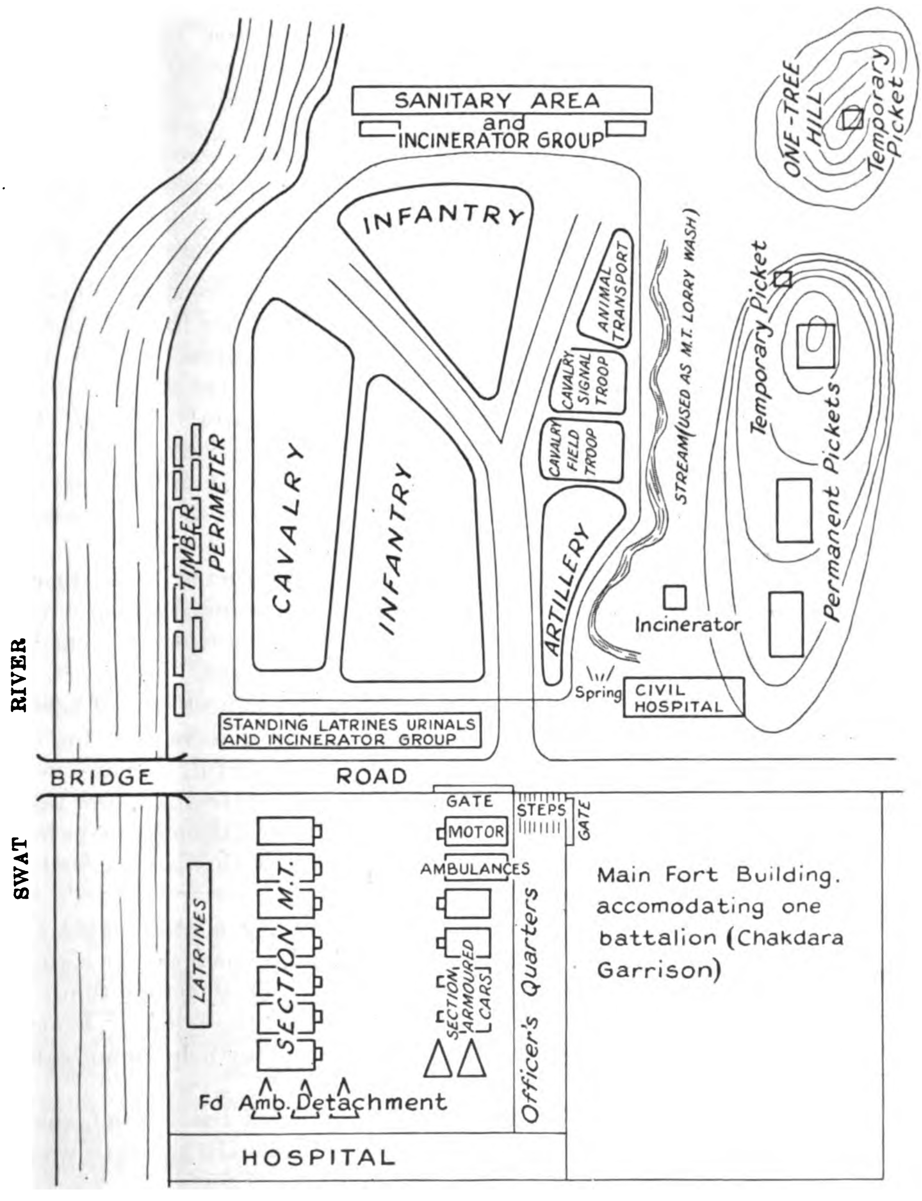
The bulk of the Force encamped outside the Fort, near the banks of the Swat River, on a site overlooked and well protected by three permanent pickets, manned from the Chakdara Garrison. Two additional pickets, each two rifle sections strong, were posted, one near the permanent picket and another further off on One-Tree Hill. The former of these was eventually withdrawn. On the second day in camp a perimeter was constructed. Part of the barbed wire encroached on the Civil Hospital area, much to the disgust of the authorities in charge. I attempted to get this section of the perimeter altered, without success, and out-patients attending the hospital were obliged to come by an alternative route. Actually, the Force was encamped, with extra precautions, on the site always occupied by the Chitral Relief Column.

The water supply was plentiful and pure, arising from a spring. Distribution was the problem, a stand-pipe only being available at first, but the Sappers and Miners overcame this difficulty by fitting a horizontal extension pipe, with extra taps. There was also in the grounds of the hospital, which was adjacent to the Fort, a spring of very pure water. This, however, I put out of bounds to troops, as without it the water supply for the Force was ample. Verbal and written orders did not suffice to prevent the sepoys from paddling in this spring, so I had an armed sentry put on it.

Conservancy threatened to be difficult, as not only were there insufficient incinerators, but the units had omitted to bring sanitary equipment. Fortunately, the situation was saved by the presence of a Military Engineering Services godown in the Fort, which I raided at my own sweet will, and which yielded all that was required. The Military Engineering Services were particularly obliging on this occasion, as, indeed, they usually are. Not only did they complete the missing conservancy requirements, but also built two excellent incinerators in the sanitary area. These, along with the Civil Hospital incinerator, which was out of commission but was patched up for the occasion, solved the problem of refuse disposal. On completion of the perimeter, night latrines and urinals in requisite proportion were provided. Unfortunately, near the river there was a great deal of piled-up timber, and this area was constantly used as a latrine. I had regimental sanitary police posted here, but they hardly minimized the nuisance. Litter was spread on marked areas of rammed earth, dried and incinerated; sufficient was retained for the construction of roads in the camp.

Cooking, never much of a problem with an Indian force, was done just outside the perimeter on unit fronts.

The question of malaria prophylaxis did not arise, the month being



February. Sick parades were held in the early morning, and the presence of the small Indian Military Hospital in the Fort was indeed a blessing, The Sub-Assistant-Surgeon attached to this hospital was worth his weight in gold, and was invaluable in helping me to put the place in order.

Although the Force depended on motor transport chiefly for its mobility. the question of pack transport had to be considered, and I had none—not a single, solitary mule. I managed, however, to persuade the havildar in charge of the animal transport detachment to supply the animals, along with a proportionate number of syces and the necessary baggage equipment. Extra mule lines, within the Fort, became necessary, and I had them built and "lipaied," by my friends the Military Engineering Services. A diagrammatic sketch of the Force *in situ* (shewn on page 15) may be of interest.

All casualties requiring evacuation were transferred to Malakand by motor ambulance, and thence returned to the Force, or to their peace stations, according to circumstances.

The first operations carried out by the Force were reconnaisances of camp-sites likely to be occupied in the event of an advance from Chakdara. Several sites were inspected, but all, except one, Serai, proved bad, because of the unsuitability or insufficiency of the water supply. Serai is one of the camping grounds occupied by the Chitral Reliefs. The water supply is plentiful, but suffers from the depredations of the local inhabitants, who occasionally divert it into their fields at different points, drying up the outfall. It is rather disconcerting for an armed force suddenly to have its water supply turned off like a tap.

At various points temporary roads had been constructed, so as to circumvent doubtful bridges. During the excursions mentioned above it was found that these roads were in extreme disrepair, so working parties, under adequate escort, were provided to put them right.

During these operations there had not been the remotest sign of hostile action. In camp, there were plenty of opportunities of recreation for the men, who, like all Indian troops, were invariably cheerful. There were, fortunately, ample facilities for football, hockey and basketball, and these games were regularly patronized by all ranks. The ambulance sepoys took very kindly to hockey and basketball, and acquitted themselves well in competition with other units.

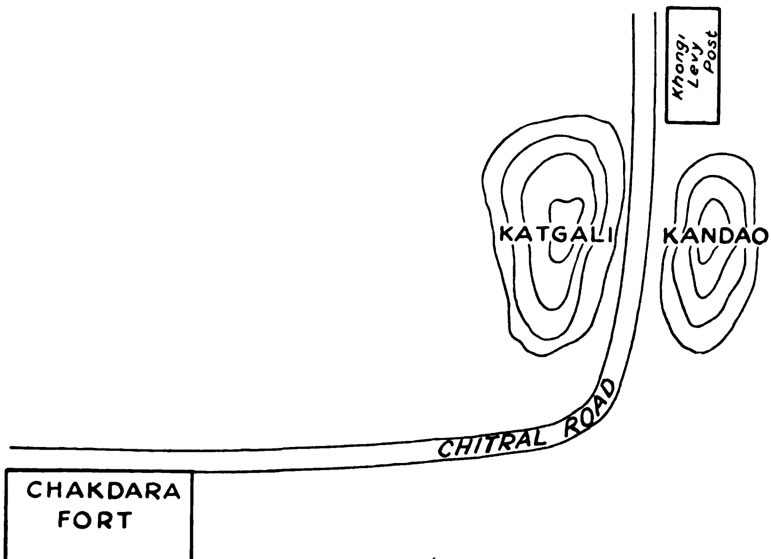
It was anticipated that the tribesmen might, if they contemplated any hostile action, seize a low pass on the Chitral Road, known as the Katgali Kandao, and attack the Levy Post at Khongi. They would thus, by holding the Kandao, interfere with any attempt at the relief of Khongi Levy Post from Chakdara. A diagrammatic sketch may help to enlighten the situation.

Consequently, the Force moved out to reconnoitre the ground, and I realized, if operations were to take place, how inadequate in strength would be my medical detachment.

Force Headquarters and Unit Commanders assembled on a small rise overlooking the proposed scheme of operations and facing the Pass. The scheme set was the occupation of the Pass in the eventuality of its being held by the enemy. This question was put to the two Infantry Com-

manders, each of whom proffered a different solution, one of which, otherwise perfectly feasible, was ruled out on the ground that the operations entailed would be too lengthy. The method of attack accepted occupied two phases. I was obliged, when my turn came, to describe the medical scheme which was elaborated as follows :—

The first phase of the attack is the occupation of the feature "A" on the true left of the Kandao. I have made the sketch on page 18 diagrammatic and omitted the dispositions of artillery and armoured cars, as these do not affect the medical arrangements. An Aid Post (I am not employing the usual terminology, since I was not provided with the usual establishment) will be opened at the point X, which affords cover, and three bearer squads of four men each (alas, my unlucky thirteen, how are they to be replaced if they become casualties?) will keep in touch with the attacking infantry, and receive from them, through battalion stretcher-bearers, any casualties,



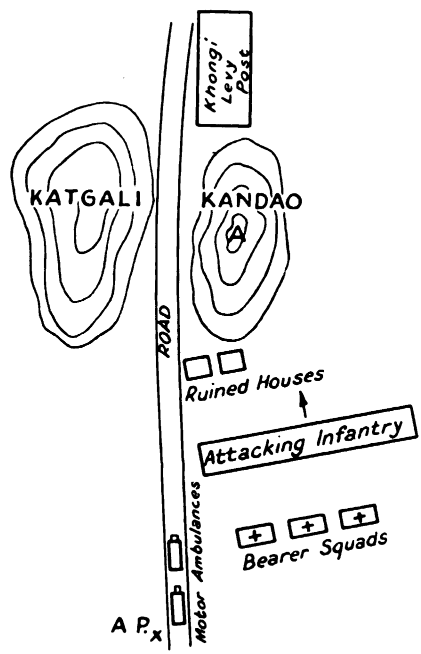
(Not drawn to scale)

which will then be evacuated to cover at the road side, to be picked up by the patrolling motor ambulances. Hostile fire might be concentrated on the road, endangering the cars, and the stretcher-bearers would be exposed, but, under the circumstances, there is no alternative plan.

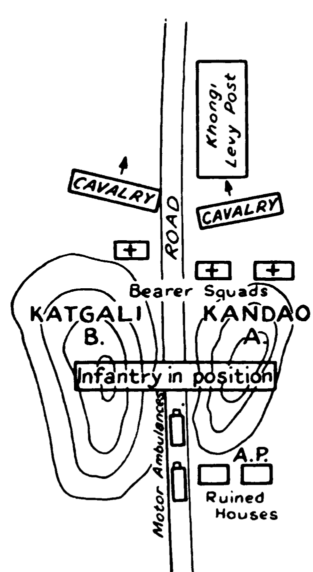
The second phase consists, firstly, in complete occupation of the Kandao by capturing the feature "B," and secondly, of a rapid cavalry advance to the relief of the besieged Levy Post, with complete disorganization of the opposing forces. During this second phase the Aid Post is situated in the ruined houses shown in the sketch, and the bearer squads, if still in existence, cover the ground behind the cavalry in extended (!!) order, evacuating casualties to the patrolling cars.

Fortunately, the tribesmen remained in their native hills, and the Khongi Levy Post remained unscathed.

FIRST PHASE.



SECOND PHASE.



At the conclusion of this exercise some firing was heard from the low ground on the other side of the road. This was investigated, and the cause found to be a fugitive escaping from justice, who was being relentlessly hunted by minions of the Nawab of Dir, to the accompaniment of the inaccurate expenditure of much buckshot. During the chase, one of the hunters, despairing of modern methods, cast away his rifle and started throwing stones. Eventually the captive was surrounded and brought to book. According to his captors, he was an escaped murderer, who was being returned to custody at Dir, and had very nearly eluded the clutches of the law a second time, slipping away unnoticed while his warders were enjoying a quiet chaupatti. I often wonder what treatment was meted out to him on his return.

In addition to the scheme worked out in connection with hostile occupation of the Katgali Kandao, combined with an attack on the Khongi Levy Post, there was some suggestion that the Force should advance up the Laram Pass, but this was never carried out. Had this been done, the Force would have had to revert completely to a pack basis, as the Laram Pass is quite impracticable for motor transport. On one occasion an armoured car got "bogged" quite near the Fort on the road leading to the foot of the Pass.

At this time, the camp site was flooded out by three days' incessant rain. The ground, however, was on a slight slope, and drained easily, consequently no trouble was caused by accumulation of water. It is a constant mystery how Indian cooks can produce hot meals at any time under an incessant downpour. On this occasion they certainly lived up to their reputation, so the men did not suffer from lack of hot food. During the rain, the Civil Hospital spring got flooded out and unaccountably filled with snakes, which were joyously captured by sepoys, then pegged out on the grass, and surrounded by an admiring crowd. I instituted a R.S.P.C.A. consisting of one member, confiscated the reptiles, which were of a harmless variety, and threw them into the Swat River. To counteract the inclement weather, rum rations, and extra tea and sugar for Mahommedans, were liberally dispensed.

After some time had passed, it was obvious that there was not going to be any "show," and that the attack on the Laram Pass Levy Post was merely a "flash in the pan." Things quieted down completely.

The Wali of Swat very kindly invited certain officers of the Force to a duck shoot on his private "jheel," which yielded about five hundred head to eight guns during one day's shoot. Snipe and pigeon were found quite near the Fort, and, for those who did not want to go further afield, "chush," a species of mud-fish, could be caught in the Swat River just outside the camp. Several hardy spirits indulged in bathing, in spite of the low temperature of the water.

It was decided, after several more days, to withdraw the Force to Dargai to await events, so I applied to be relieved, not cherishing the idea of sitting idle in Dargai Fort for an indefinite period of time. My relief arrived very soon afterwards with a ration convoy, and I returned to Peshawar.

THE DOCTOR'S WAR, 1899-1902.

By D.A.D.M.S.

When my son was a small boy, just before the outbreak of the Great War, he liked to be told stories when tucked up in his cot and prepared for sleep. I regret to say that in those degenerate days little boys liked stories about wars, so he invariably asked me to tell him a story about "My old Boer War." So that even in 1914 it was an old story of a queer sort of war fought out in a huge sun-drenched country, and between people who had a great deal in common and a sneaking liking for each other most of the time. It was fought without malice or bitterness on either side, but as is the case in all wars, those who did not fight spoke and wrote with great bitterness and, sad to say, the echo of their hard sayings is still heard in that sunny land where war raged for two and a half years, and still poisons minds far too young even to realize what it was all about. So if anyone wants to hear about those old days I have a yarn to spin based upon what I can remember and on an old scrap-book kept by my sister and into the leaves of which she pasted letters I wrote mixed up with odds and ends culled from the papers of the time. When the war started I was doing my first job in the Army as a Lieutenant in the Royal Army Medical Corps stationed at Strensall Camp in Yorkshire. The camp was partially hutted to accommodate half a battalion of the Yorkshire Regiment and various Territorial Units that came there for training. A Major R.A.M.C. was in charge and I formed his staff. We had a small hutted hospital for a few beds ; any serious cases were sent to York. During the summer I lived in a tent in the camp and the R.A.M.C. personnel, consisting of one cook and two orderlies, helped me to run a small tented hospital. It was a pleasant life, a fair amount of work, a bit of rough shooting, and some tennis and entertainments at neighbouring houses. However it did not last long. As winter approached the camp closed down. I had the somewhat strange experience of being left alone as medical attendant on a young officer who contracted enteric fever and was in too serious a condition to be moved. I had a nurse down, his father and mother arrived and were accommodated in a hut, and we formed a small party left there on Strensall Common. I visited the young man twice a day and he became convalescent in a few weeks time. What was his ultimate fate I do not know as war was declared on November 11, 1899, and I was suddenly ordered to report myself at York Military Hospital. On arrival I found York humming with activity, reservists rolling in daily and the R.A.M.C. Company busy mobilizing for war. I remember one or two hectic days examining reservists for the Units stationed at York. The men were all in good spirits. Some had perhaps exceeded somewhat, but they were a fine lot of fellows and

showed no signs of resentment or feeling about their work in civil life being so abruptly interfered with. Rather on the contrary, they were in high spirits and seemed quite pleased to be rejoining the colours and going off to fight a war in a far-off country. The R.A.M.C. Unit was the 10th Field Hospital, but for some reason I was kept behind, and had the mortification of seeing them off at the station. It was only a few days delay, however, and I received orders to embark on the S.S. "Orcana," Pacific Line, No. 40 Transport, carrying the 1st Battalion Argyll and Sutherland Highlanders and a Detachment of No. 8 Company, R.A.M.C. My command consisted of one serjeant and two privates of the R.A.M.C. Fully equipped in khaki, with sword, haversack, water bottle, field glasses, etc., I took over my party on York Station on a Sunday morning and entrained for Liverpool where we were to embark on the "Orcana," docked at Birkenhead for passage to South Africa, via Queenstown, where we would pick up the Argyll and Sutherland Highlanders. I felt very important and warlike as I sat in a first-class carriage on my way to WAR. I regret to say my tranquil musings over what was before me were rudely interrupted at the next stop. My sergeant appeared at the window and informed me he was having trouble with the detachment. It appeared one of the two warriors had secreted on his person a bottle of whisky, and had been steadily swapping drinks with his fellow soldier. In point of fact they were both getting uproariously tight. Wishing to preserve my dignity I ordered the serjeant to be very severe with them and remove the bottle, or what was left of it. He came back several times to report progress and finally at a longish halt I got out to see what I could do. I found my two gallant privates singing lustily at the carriage window surrounded by an admiring crowd of civilians who cheered them on to further efforts and encouraged them by passing bottles of beer into the carriage. With some difficulty I managed to explain to the people that they were not doing the fellows any good and stopped this war enthusiasm.

I may remark that the Sunday train we were travelling by was painfully slow and stopped at many stations, consequently the temptation to the travelling public to show their patriotism was pretty frequent. In due time we arrived at Liverpool. I there discovered that the river subway train service to Birkenhead did not function on Sundays and the river would have to be crossed by ferry-boat. I placed myself and my kit in one four-wheeled, horse-drawn cab, and directed the sergeant to place his detachment in another cab; by this time the Army was quite beyond the walking stage, and so we solemnly drove to the Docks. The ferry-boat was crowded with Sunday holiday-makers, and they took very kindly to the further entertainment of my troops. I believe the crowd actually sang "Soldiers of the Queen," and I know several brave souls shook me warmly by the hand and wished me all sorts of luck. The same cab conveyance was necessary on the Birkenhead side. I recollect my

subsequent claim for cab fares was coldly turned down by the paymaster, who pointed out that troops embarking for active service were expected to march from the de-training point to the point of embarkation. The answer to that in these days would be "Sez you," but such transatlantic slang was unknown in 1899.

All is well that ends well. The two privates turned out to be very good fellows and worked hard and faithfully during the voyage to the Cape. I hope they got through the war all right and had as hectic a return as their setting out. I found the s.s. "Orcana" empty, excepting a few details like ourselves, and a few staff officers. We were to cross to Queenstown in Southern Ireland, and pick up the fighting troops. As practically all the first-class cabins were empty, an obliging steward picked me out a very nice single-berth cabin on the upper deck in close proximity to a nice bathroom. I accepted this accommodation in all innocence of my humble rank of lieutenant; and, strange to say, I held on to that cabin all the voyage, even though some fierce-looking majors glowered at me on my way to what I discovered later was the senior officers' bath. The ship belonged to the Pacific Line, and was employed on the South American passenger service. She was very comfortable. One strange custom she had of serving claret at breakfast and lunch as a free drink soon came to an end, whether from exhaustion of supply or by request of the officer commanding troops, I do not pretend to know. It was a very popular custom while it lasted. On October 25 we sailed from Queenstown, having embarked the 1st Battalion Argyll and Sutherland Highlanders, commanded by Lieutenant-Colonel G. L. Goff, the embarkation was uneventful, and we sailed away from Ireland, cheered by a large crowd and lighted by flares on the surrounding headlands. I duly reported myself to the Senior Medical Officer on board, one Captain E. Carter, R.A.M.C., who was going out to Africa as M.O. to the Argyll and Sutherland Highlanders. The voyage to Cape Town is a placid and peaceful one at all times, and more so on this occasion, as we only stopped to coal at St. Vincent, missing out the usual points of call, such as Las Palmas or Madeira. It is also a voyage through quiet, calm waters; rough weather may be encountered at the start, and again when nearing the Cape; but it is usual to find calm seas most of the trip. Though on the way to war, we were in those days before wireless completely cut off from all communication with the world for weeks, and many were the earnest conversations about the possibility of arriving in time. The pessimists said the war would be over before we arrived at Cape Town. "Why," they said, "There is Sir George White in Natal with 6,000 troops, what is to prevent him marching straight on Pretoria and forcing Kruger's surrender in the three weeks we are at sea." Little did we imagine 1899-1900-1901-1902 stood between us and the end of the War. The troops were exercised and practised in war methods and the slow days drew on. One circumstance made our ship somewhat unique. The O.C. had firm convictions about

the dress of officers on active service, and especially against an enemy who were known to be fine rifle shots. His theory was that the Boer would inevitably pick out the officers by the distinctive dress and shoot them down. Obviously the correct thing to do was to make the officer indistinguishable from his men. To arrive at this state of affairs officers were dressed exactly as the men and for ship's use were issued with khaki tunics from store, and khaki slacks to wear during the day, and for mess dress the home pattern walking-out tunic of the men and plaid trousers. Also no officer was to shave. You can imagine what the dining saloon looked like twenty days out from Home. Field officers with fierce bushy beards, tight short tunics and trousers an inch or so short of the ankle; a field officer's figure is not suited to such a garb. Thin young subalterns with fluffy whiskers and oversized clothing. The general effect was somewhat comic. We were a very cheery ship. In those days smart Scots regiments were pretty well to do; they may be now for all I know, and officers were pretty free with their money. A selling sweep on the day's run was an exciting event after dinner and prices ran high.

One beautiful starlit night I was called to see two men who were found unconscious on deck. There was a bright moon and it was as clear as day. The officer who had called me was quite sure that the two sufferers were stricken by "moon-stroke." They had been sleeping out on deck fully exposed to the soft rays of a tropic moon. I had my doubts of the diagnosis, as both victims smelt heavily of alcohol. I had them both carried below to the troop hospital and treated energetically by means of an instrument known as a stomach pump. Much dark, blood-coloured fluid was extracted to my initial dismay, until I gathered that the fluid was claret, and the victims subsequently confessed that they had been employed that evening as extra attendants for the dining saloon, seized the chance of pinching half a dozen bottles of claret, drank off the contents, and managed to get on deck before they collapsed. So much for the "moon-struck" warriors.

As we approached St. Vincent our excitement over possible news was intense. Steaming towards the Island we passed close to a ship coming out. We put up a large blackboard and wrote "any news." The other ship read our message and replied likewise. To our consternation we read "Disaster to our troops, 800 prisoners taken at Nicholson's Nek." That was the bare message we got. It shook us a bit, and our experts who banked on the war being over before we reached Cape Town had a very decided slump. Nothing else of any note happened until we steamed into Table Bay and saw the majestic Table Mountain shrouded in its fleecy covering of clouds.

The berthing of the ship was rapidly carried out under the direction of the senior naval officer and his staff. Table Bay was full of transports and ships carrying war material and munitions. I think the Argyll and Sutherland Highlanders were disembarked into a troop train waiting on

the quay. Anyhow they rapidly disappeared and I was left on board with my R.A.M.C. detachment to await the arrival of the 10th Field Hospital in another ship that sailed before us, but had been delayed somewhere, or had not the pace of the "Orcana," anyhow she had not appeared as yet.

I forgathered with the ship's doctor, one L. F. O. L'Estrange (now Lieutenant-Colonel, R.A.M.C. (Ret.)), and we investigated Cape Town. There was very little news in the town and the war seemed a long way off. One noticed that people did not talk about it very much, and there was a sort of air of restraint present. This was, of course, due, though we did not know, to a strict censorship over news from the front, and to the fact that Cape Town held many friends and sympathizers of the Dutch Republics we were fighting. This was not to be wondered at when one remembered that the Dutch founded Cape Town in 1650 and remained masters of South Africa until 1814, when the country came definitely under British rule. The mark of the Dutchman is strong in the Cape, his attractive Colonial white-washed houses with deep pillared stoeps are to-day the outstanding features of the landscape, and were more so in 1899. Many families in the Cape had relatives and friends living in the Transvaal and Orange Free State who automatically became enemies on the outbreak of war, and house was divided against house indeed. From this point of view the Boer War was in South Africa a civil war dividing family against family. So it will be easily understood that Cape Town had little to say about the war.

I was given a job of work in escorting an ambulance load of sick men from the docks to the military hospital at Wynberg. This pleasant suburban locality is eight miles from Cape Town and we did the journey all the way by road in the well-remembered, and still to be seen, horsed ambulance wagon. Unfortunately for me the early summer in the Cape is accompanied by a very strong wind called a south-easter, also known as the "Cape Doctor." The latter name is given because, as it gets hot in October and November, this powerful wind blows away dust and cools the land. I met it all right in my drive to Wynberg. Sitting as I was on the front seat with the driver, we met the full blast. Showers of dust and small grit blew in our faces. Many times the horses had to stop and turn away from the blast. It was a long eight miles. The sick men inside, they were mild "sitting-up" cases, were more protected, but I don't suppose they enjoyed it much. Finally, we arrived at a picturesque hospital set among fir woods and bright with grass lawns and flowers. A beautiful setting on the slope of Table Mountain, where the red grape-bearing soil is heavily cultivated. And the vineyards cover the land. I was very kindly received by the staff of the hospital and notwithstanding the Cape Doctor I thoroughly enjoyed my visit to Wynberg. There and then I made up my mind that I should some day be on the staff of the Wynberg Military Hospital, and so I was, but I had to wait until 1902!

The next day my lost Field Hospital arrived, and I received orders to join them. Incidentally it was just a chance that I was not sent on

to Natal instead of joining my own unit; had that happened I would have seen the war from quite a different angle. My Field Hospital entrained for the north—destination unknown—but somewhere fighting was extremely likely. So we started on a long hot journey in a very slow troop train, trailing up from the delectable lands of the Cape Colony to the high and arid plains of the Karoo. From the carriage window one watched endless level plains covered with a short scrub bush, broken occasionally by a small rock-covered elevation known in the vernacular as a "kopje." And now and again one saw an isolated farm house, low built with corrugated iron roofing, a few trees, and the everlasting windmill pump. This, understand me, was what one saw in the barren Karoo thirty-four years ago. I daresay it is very different now. The dust seeped through everything, one lived in a fine film of dust. A great sun-drenched and bleached land; later one knew that when the winter rains came this same Karoo would be green and rich with wild flowers. One memorable halt was at Matjesfontein. Here we were met by the genial proprietor of the town hotel, railway-refreshment rooms, and the surrounding veldt. All officers were invited to a champagne dinner and the troops were suitably entertained. As the laird of Matjesfontein was doing this for every troop train that passed through he was undertaking something big. Or perhaps he only did it for Scots soldiers. At last we arrived at Orange River Station, where there was a huge accumulation of troops and stores preparing for the advance on and relief of Kimberley, the City of Diamonds and the home of Cecil Rhodes, the builder of empires. The city was besieged and crying out for relief. The first people I saw were my old friends, the Argyll and Sutherland Highlanders, busily employed unloading stores. I got off our train and had a buck with them. Much to their disgust they found themselves at this lowly work instead of fighting. According to what I gathered we were just in time to join Lord Methuen's division which was actually on the move when we arrived. The Commanding Officer of our Field Hospital came bustling back with news.

It appeared our arrival in time was despaired of by the Principal Medical Officer (Surgeon-General Townsend) and a Colonial personnel had been collected and detailed to move off with the troops in our place. I understand our equipment, transport, horses, etc., had been handed over to them and they were on the point of marching off when we arrived. I can recollect a somewhat hurried and almost heated interview between our O.C. and that of the Divisional Field Hospital; but the ultimate result was that we took things over as they stood, and marched off after the troops. It is as well to say here that in those days the modern field ambulance did not exist. The Field Medical Unit was called a Field Hospital and provided accommodation and treatment for 100 wounded and sick. Another medical unit, called a Bearer Company, did all the collecting of the wounded and brought them to the Field Hospital. Both units were quite distinct and had different commands. Later on it will be shown

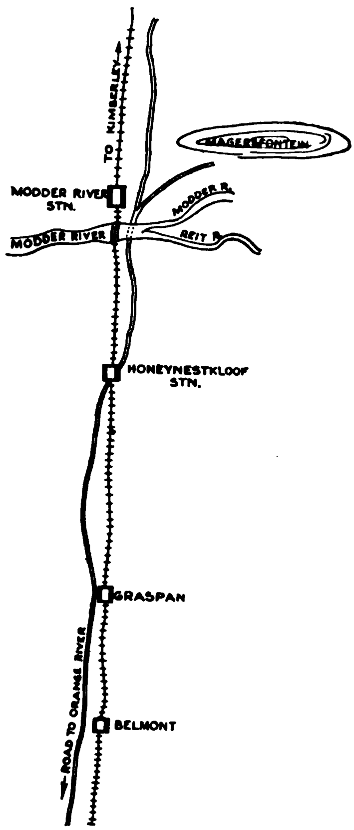
how wasteful this dual system was. As we moved off one could see long lines of infantry advancing in extended order over the dull yellow plain, the khaki of the men made them strangely difficult to see against the parched, dusty veldt. The date was November 23, and we were actually coming right into the battle of Belmont, the first action fought by Lord Methuen. As we came nearer we saw the line of kopjes standing up from the level plain, saw the flashes of our shells bursting, and heard the low incessant rumble of continuous rifle fire punctuated by the roar of the guns. It was awe inspiring for one who had never before heard a shot fired in anger. We pressed on and presently received orders to pitch our Field Hospital and prepare to receive wounded. Soon the casualties arrived and we got down to work. It was noticeable that most of the wounds were in the legs or abdomen. This was due to the Boer habit of firing low at attacking troops. Our men had advanced over the open and finally stormed the hills the Boers were holding. The enemy held on grimly, but broke before the firm advance, and streaming down the reverse side gained their horses, mounted, and were away out of range in a scattered mob. I gather from notes made at the time that our total losses were 50 killed and 240 wounded. I know we passed 80 wounded through our Field Hospital and had 10 deaths.

One of the wounded was a young Boer who did not look more than 15 years of age. He was a fair-haired boy, strong and well built, and badly hit. He was dressed in a pair of corduroy trousers, a shirt and plain tweed jacket. On his feet he wore the Boer shoes of soft leather called veldt-schoens. He had no resemblance whatever to a soldier, he looked exactly like a Belgian refugee shot in the early days of 1914. Later on his father came to see him. A tall heavily bearded middle-aged Boer, wearing the same sort of rough country clothing. I was told he came back and surrendered to us when he missed his son, and heard he had been seen to fall during their retreat. I know he sat for hours beside the stretcher on which his boy was lying ; he was quite quiet and grave, spoke no English, and was grateful for anything we could do for the lad. I cannot remember whether the boy lived or not.

All that night I was busy giving anæsthetics and dressing wounds. Our total staff was the O.C., a major and two lieutenants, and a quartermaster. We were certainly not overstaffed. Some time in the early morning we transferred all our cases to a hospital train which must have practically followed us into action. On the platform was the old Surgeon-General and his secretary (the designation was then P.M.O. and secretary), Major Burtchaell (the Sir Charles of the Great War). Having seen our wounded away we returned to camp and proceeded to turn in. I was feeling pretty cooked and our trusty quartermaster persuaded me to have a mug of coffee well laced with ration rum—good stuff that!

At some unearthly hour next morning, I think 4 o'clock, I was roused by loud cries outside our tents ; popping my head out I was astonished to

see Surgeon-General Townsend seated on his pony, cursing everyone in sight because we were not packed and ready to move. Being a mere lieutenant I was never told why the P.M.O. had to come and tell us that we must move. It seemed a bit odd. Off we went in the chilly dawn of the high veldt and soon after heard firing in front. It is to be remembered that Lord Methuen was advancing straight up the railway line on Kimberley, and the Boer plan was to oppose his advance at each strategical position; that is at any point on the line where the rocky outcrops formed long low ranges of hills. The second position they took up was at Graspan or Enslin, it seemed to have two names.



The latter was the name of the actual railway station, I imagine. The nature of the action was much the same as at Belmont, a slow advance over open veldt, shelling the kopjes and a final charge. Again the Boers stuck close to their rocky defences, shot straight and well, and cleared away on their horses when they saw the attack could not be held up. The actual fighting took some four hours and we lost 24 killed and 166 wounded. Our Field Hospital was not used at this fight so we were merely spectators. I rode forward to see what the position was like and talked to various officers and

men who had taken part in the battle. It was here that the Naval Brigade came into action and took a gallant part in the final charge up the kopje. I met a very excited Padre who had been the militant christian and followed his battalion all the way. He was most indignant because some staff officer had ticked him off for being so far forward. It was reported that the Boers lost 400 killed at Graspan and 140 at Belmont. I wonder! We were doing all the attacking and it seemed more reasonable to think our losses would be heavier than those of the enemy fighting from concealed positions.

The evening of that day, November 25, we had a rapid and dramatic change in our Field Hospital. We were sitting outside our bell tent when a mounted orderly clattered up from G.H.Q. and delivered a field message to the O.C. The result was a change of command and personnel within the hour, so to speak, and we became a personnel of one major as O.C., and two brave subalterns. The new O.C. was a genial soul, and to our astonishment arrived complete with a cinematograph camera. Actually " movies " but *not* " talkies " in the old Boer war!

I heard a good story typical of the Boer's attitude towards our Army to start with, and his confidence in his shooting powers. A British Colonial told an old Boer that if they went to war the English would send out a whole Army Corps from England to fight them, and what would he do then? "We shall shoot them," was the abrupt reply. "Then the English will send out another." "Well, we shall shoot those also." "But," continued the Colonial, "England can go on sending an Army Corps every year for the next twelve years." "Allermatche," exclaimed the Boer. "You don't mean to say I shall have to go on shooting Englishmen for the next twelve years!!"

The Division moved on once more following the line of the railway towards Modder River. The rough plan above will show the line of advance and our objective Kimberley.

(*To be continued.*)

THE CLASSIFICATION OF SICK AND WOUNDED IN THE FIELD.

By Colonel SCHICKELÉ.

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In 1931 and again in 1932, on the occasion of the first and second Sessions of the International Office of Military Medical Documentation at Brussels and at Liége, I had the pleasure and the honour of addressing you on the subject of the evacuation of the sick and wounded and the provision of hospital accommodation in their relation to the organization and functioning of the Medical Service in the field. On the present occasion I propose to speak to you about the medical and surgical classification of sick and wounded.

These words imply that by the application of one of our methods of procedure a sick or wounded man liable to be evacuated becomes after examination a case for prognosis with a definite indication of the specific treatment necessary.

To appreciate fully the nature and importance of the classification of the sick and wounded we must consider this operation at the stage in which the best results can be attained.

You are already aware that the experience of a long war clearly demonstrated the necessity of establishing hospital centres well behind the front line. I have shown that to reach the chief hospital centre evacuation was essential. I explained that the means of transport adopted for this evacuation had to be available within a limited time, depending on the degree of urgency of the lesions necessitating more or less urgent treatment. I endeavoured to show you that there must be a corresponding succession of hospital establishments, each being reserved for special degrees of urgency. I concluded by formulating the general principle that sick and wounded should be evacuated directly to the hospital suitable for their particular requirements.

The sorting of sick and wounded is carried out for this specific purpose and is a means of ascertaining, in the case of each patient examined, the nature and gravity of the disability on which the urgency of treatment will be determined and, as a direct and immediate consequence, the hospital to which he should be sent.

Again, this sorting will indicate necessary treatment before evacuation, the choice of the means of transport according to the degree of comfort required from the nature and gravity of the lesion and the possibility of the patient travelling as a sitting or lying case.

This simple explanation will enable you to realize, from the beginning, the importance of classification of patients and the inherent difficulties.

The first question which arises is: where should classification take place?

The ideal plan is that sick and wounded should be sorted out as early as possible, therefore the first medical officer to attend the sick or wounded man should classify him. This method appears all the more rational because this medical officer always sees wounded and sick as soon as they are brought in, and examines them before any treatment has been given and, in the case of wounds, before they have been dressed.

In spite of its indisputable theoretical advantages, this method has proved impossible in practice. Except in rare periods of calm when the number of sick and wounded evacuated daily does not exceed a few cases, the battalion or regimental medical officer will be unable to make a correct classification. It may also frequently happen that he is not fully qualified for the duty.

I should also mention that from this forward area a considerable number of evacuated men may never pass through the regimental dressing station but proceed directly further to the rear thus escaping examination. It may be added, however, that these are the exceptions.

If the classification of sick and wounded cannot be satisfactorily carried out in the regimental area, it is nevertheless of obvious importance to keep a record of the diagnosis of the first medical officer to see the evacuated man. This is the object of the front line medical card, which has, fortunately, been standardized and can easily be referred to by all, and becomes, later on, a very important document for final classification.

At the beginning the regimental medical officer must of necessity decide as to the priority regarding the urgency of transport to the nearest dressing station in the rear. It is to this extent only that he is concerned in the classification, which is carefully limited to the means at his disposal.

The next question to be decided is which medical unit should be responsible for sorting out the sick and wounded.

There are two possible solutions: (1) To set aside a medical unit for this important duty; (2) to arrange classification by all the hospital centres which would check each other's work in turn.

The specialized field medical unit for this sorting out is certainly the best and final solution. The stream of evacuated patients reaches this unit without classification and after sorting is divided into the various categories corresponding to the special hospitals concerned.

To ensure efficient service this unit must be sufficiently close to the front so that the destination of each patient may be decided as soon as possible. Further, this classification must be final and not subject to later alterations —two conditions not readily compatible.

A unit close to the firing line suggests a temporary and therefore precarious organization with limited scope for action. Such an arrangement would not fulfil the essential conditions for complete classification,

that is examination of the wound with dressings removed and controlled by such special means as X-ray examination. It will be readily understood that an organization of this character requires a large, highly trained and specialized personnel.

As there may be very heavy casualties, these sorting units are very liable to be overcrowded and blocked by the continuous stream of patients. When this happens there is a tendency to deal first with the seriously wounded, and to keep the others waiting so long that their condition is aggravated and sometimes becomes dangerous. Moreover, since all wounds have to be uncovered for medical examination, fresh dressings have to be applied and splints readjusted. This entails loss of time and considerable expenditure of medical equipment, besides adding to the sufferings of the wounded.

The French Army experimented with the specialized medical sorting unit through which all sick and wounded evacuated from the front had to pass. This was in September, 1915, during the attack in Champagne, and resulted in systematic congestion of the unit and a very great slowing down in evacuation. This arrangement, which was too theoretical, had to be abandoned as it did not make adequate allowance for the practical difficulties.

The second solution is what I have called evacuation in successive waves (*en cascades*). The evacuated men pass in succession through all the hospital establishments in each of which they are subjected to a medical inspection which amounts, in practice, to classification. Each hospital retains the cases for which it is adapted and sends the others on to the next hospital centre.

This system has given good results, but it has the grave defect of multiplying the successive classifications, with the objections already noted in regard to the specialized sorting unit.

In short, none of these is a completely satisfactory solution of the problem of sending the evacuated man directly, and as rapidly as possible, to the hospital in which he will receive the particular treatment required. They all have the common initial error of aiming immediately at complete and definite classification.

This is, for a very good reason, both irrational and impossible. A final classification can only be made when the evacuated man is actually in bed at the hospital in which his treatment is to be carried out. Until then the classification is liable to revision. We have all come across cases of wounded and, in particular, gassed men whose condition has changed materially from one hour to the next. This change nearly always means aggravation. The prognosis changes and, at the same time, the degree of urgency which necessitates different treatment.

This seems to indicate that the classification should consist of a series of procedures effected with as little delay as possible and ranging from the simplest to the more complicated until classification is definite.

Instead of dealing with theoretical considerations on this question, I think it simpler to explain the solution adopted by the French Army

Medical Service in the Regulations on the Organization and Administration of the Medical Service in the Field, December 11, 1930.

In the divisional area a rough classification of sick and wounded will be effected at the divisional dressing station, which should not be more than 5 miles from the front line. For this purpose all the evacuated must pass through the divisional dressing station where they are examined, but only with regard to the entries on the front line medical card and such evidence as may be available from external clinical signs which are easily and quickly recognized, such as the facies, pulse and breathing.

The wound will be uncovered only in exceptional cases unless a fresh dressing is required.

After being examined without removing the dressing, the evacuated man is dealt with under one of the six principal methods of disposal :—

(1) Cases unfit to be moved : treatment given on the spot.

(2) Most urgent cases : sent to the Corps Hospital Group.

(3) Urgent and less urgent cases : sent to the primary casualty clearing station or to an Army Hospital.

(4) Slighter cases requiring a short period of treatment : sent to a centre for slight cases.

(5) Minor cases : sent to a Convalescent Depot.

(6) Cases likely to recover very soon : sent back to the front.

The number of these principal methods of disposal may be increased, depending on the medical arrangements at the front. Thus centres for various special medical and surgical cases may be established, e.g. centres for gassed cases, for fractures, for skin and venereal cases, and nervous and mental disorders.

For each particular case, the medical establishment suited to the different categories of sick and wounded will be given in a general plan of treatment and evacuation arranged for each army.

Classification at the divisional dressing station is of the greatest importance, but it is neither definite nor final. The arrangements might be more accurately described as the switchboard of evacuation and classification. In the French Medical Service the divisional dressing station is really a turn-table controlling evacuations from the front. From there the evacuated men are sent to the medical centre best suited to their condition, but this decision is neither final nor unalterable. Medical units further back are responsible for correcting the unavoidable mistakes made by the classifying unit. The most important of these units is the Corps Hospital Group where the most serious cases are received. In the French Regulations care has been taken to recommend that the divisional unit should give a wide interpretation to the term "serious cases." In this way it is estimated that the Corps Hospital Group will receive twice the number of cases that should normally reach them. In reducing the flow of evacuation to figures, it is estimated that this Group will receive ten per cent. instead of five per cent. of the men evacuated from the front.

This is really a very minor defect since it refers only to one-twentieth of of the evacuated, whereas nine-tenths of the latter will have been given their correct destination.

In practice this result may be considered very satisfactory compared with medical evacuation in general.

The task of regulating and classifying assigned to the divisional medical unit is amply sufficient and there is no need for it to attempt a final sorting out of the cases.

Circumstances may arise, however, when the sudden influx of great numbers of evacuated men will render this task difficult if not impossible. Congestion must at all costs be avoided. The French Regulations provide very wisely for such a contingency by instructing divisional dressing stations to evacuate without classification to the Corps Hospital Group all patients they have been unable to deal with. The Army Corps Groups will in such circumstances take the place of the overcrowded divisional dressing station. If, in its turn, the Army Corps Group is in the same predicament, patients who cannot be dealt with will be sent to the primary casualty clearing station.

There will be a time, however, when the system of sending the overflow patients to the rear must be stopped, as otherwise an evacuated man might reach a hospital well away in the home country without any classification. To prevent such an occurrence, the French Regulations provide that no evacuated man shall go beyond the primary casualty clearing station without having his wounds examined. This means that classification is concluded at this stage and that beyond it only unforeseen alterations will be allowed. The barrier at the primary casualty clearing station at about nineteen miles from the front is brought into action again some sixty-two miles further on, at the secondary clearing station beyond which no patient may be transferred without having previous hospital treatment.

You will note that the French Regulations on the organization and administration of the Medical Service in the field have adopted a compromise between the specialized sorting unit and the passage of the sick and wounded through successive filters. Classification has been arranged in stages from its simplest form to the more complex, the successive hospitals being responsible for controlling one another by giving each other mutual support and by forming, one behind the other, two barriers which cannot be passed without examination ending in correct classification. These two barriers have been carefully located, one at the point of joining the ambulance train and the other on leaving the Army zone.

By these decisions the French Military Medical Service appears to have adopted the most flexible system and the one best adapted to the varied circumstances of modern warfare.

Whatever method is adopted for classification of sick and wounded, it must on no account interfere with the normal system of evacuation as it would thereby defeat its own purpose.

This is a highly important consideration which must be borne in mind.

For correct classification a method of classifying the sick and wounded in various categories must be arranged beforehand.

Hitherto this classification has been based on the possibility of moving the patient and there were three categories : men fit to be evacuated, men unfit to be evacuated and men unfit to be moved.

In practice, it has been found that this classification is quite inaccurate as, according to circumstances, it is perfectly feasible to place an evacuated man in any one of these categories. Under pressure from the enemy a patient unfit to be moved would be evacuated, and this, on the face of it, is an absurdity. Similarly, if a comfortable and rapid means of transport, such as an ambulance aeroplane, were available, it would be possible to transport a sick or wounded man who could not possibly be evacuated in an improvised ambulance train.

As a result of his experience during the War, Professor Lardennois of Paris proposed, immediately on the cessation of hostilities, that the sick and wounded should be placed in categories depending on the gravity of their condition.

He suggested four degrees of urgency :—

The *morituri*, whose expressive designation indicates their condition and the impossibility of attempting to evacuate them.

Serious cases in which medical treatment must be given within six to twelve hours after the man has been wounded or taken ill.

Urgent cases (second degree) in which medical treatment can be delayed for between twelve and twenty-four hours.

Less urgent cases (third degree) in which treatment may be postponed for twenty-four to forty-eight hours.

Slighter cases requiring a short period of treatment might be included in the less urgent cases.

It is certainly interesting to present in figures the relative importance of these various categories. The following table has been compiled from data taken from statistics drawn up during the Great War.

Categories	Wounded	Gassed	Minor cases	Total
Dying	1	—	—	1
Serious cases	4	1	—	5
Urgent cases	13	4	—	17
Less urgent cases ..	37	25	—	62
Slighter cases.. ..	9	4	2	15
Total ..	64	34	2	100

These figures are useful only for reference. They give values which circumstances may modify. For instance, the proportion of gassed and wounded men may vary according to the employment of toxic gases and their concentration.

Although there may be still many unknown factors regarding their effects, it is quite possible that in the future these proportions will not vary materially.

For the present, in any case, these figures may be taken as a basis for judging the results of classification.

For each category of evacuated patient there is naturally a suitable hospital which may vary according to the various organizations of the Medical Service in the field without any appreciable modification as a whole.

The *dying* must be accommodated as quickly as possible and the divisional medical unit seems the organization best suited to receive them.

Serious cases should, as a rule, be dealt with in the Corps medical units.

Urgent cases will be sent to Army Hospitals nearest the front.

Less urgent cases will be distributed among the medical units in the lines of communication and those situated in the area separating the zone of the armies and the interior.

The slighter cases may be kept either at the front or sent to distant hospitals depending on the military situation. During periods of calm the slighter cases will be kept at the front where, after recovery, they can at once rejoin their unit.

During critical periods, on the other hand, slighter cases will frequently be sent to the rear so that they may be away from the fluctuations of the struggle and so relieve as much as possible the field medical units dealing with the troops in the field.

The object of classifying casualties is to allot them to the various categories—a simple operation.

Difficulties arise when it is necessary to decide on the nature of the lesions to be allocated to each category. It is certainly always possible to foresee that a man with multiple fractures suffering from shock and hæmorrhage will always be a serious case. All typical cases will be equally easy to classify, but borderline cases may be variously judged and placed, accordingly, in different categories. Prevailing circumstances may also influence the decision. The same measures would not be adopted in a quiet period as during a period of great activity. The number of casualties may hasten evacuation when otherwise it would have been better to delay moving the patients. Enemy pressure may also hasten evacuation. The quality of the means of transport, the comfort they afford and their speed, are conditions to be taken into account and may cause some cases to be evacuated which under other circumstances would have been retained at an advanced hospital. For all these reasons it appears difficult, if not impossible in practice, to draw up beforehand a list of the lesions which are to constitute the respective categories of those evacuated. The wisest course is, therefore, to await events and then, taking all the circumstances into consideration, to decide as to the best means to be adopted.

The Army medical officers will be responsible for giving definite instructions as to the line of action to be followed. This must not be too rigid and absolute, for no two cases, although apparently similar, are exactly the same. This is where the classifying medical officer must show his foresight and efficiency. It would be a great mistake to imagine that

classification of the sick and wounded is a minor duty which can be undertaken by any doctor who has not specialized. In particular, the sorting of surgical cases must be carried out by an experienced surgeon and the same applies to medical classification, especially in the case of the gassed, who must be divided into categories in the same way as the wounded. The French organization allots this task to surgeons of the surgical teams or to physicians of the medical teams, grouped in teams of three shifts working by the three-eighths rule, that is to say : eight hours full time ; eight hours half time, which includes sorting and dressing the wounds ; and eight hours of complete rest.

Even under these conditions, the physicians and surgeons in command of hospitals where sorting takes place must frequently personally supervise the process of sorting and carefully watch the work of the teams.

So far we have analysed the question by studying successively and separately evacuation, treatment and sorting.

In reality, as I explained at the beginning of this lecture, these three elements are so closely and indissolubly connected that they form a whole. They are the three pillars on which any organization of the modern medical service in the field must be founded. Their value should be considered as one of the most cogent and definite lessons of the Great War. It will be maintained, in essentials, whatever may be the form of future warfare. Without posing as a prophet it is safe to say that in all armies there is a tendency towards acquiring the greatest possible mobility. This is the inevitable outcome of the organization of modern armies which consist of not more than a small permanent nucleus. It is an essential if stabilization, the disastrous effects of which have been experienced, is to be avoided. Motor transport and mechanization of armies contemplated by all nations, and already introduced in some of them, open out, even at this stage, an immense field of new possibilities. Sudden and rapid military operations in distant areas combined with deep penetration of the enemy position will render medical aid in the fighting line more and more difficult if not impossible. In the majority of cases, it will certainly be necessary to establish definitely large hospital centres in the back areas, reached by means of a rapid, flexible and efficient system of evacuation.

If this system is to be carried out without exposing patients to excessive risks, it will be necessary, from the first, to make it dependent on a judicious classification of the sick and wounded. The number of cases to be dealt with on the spot will certainly be reduced by improved means of evacuation, but they will never be altogether eliminated. It follows that the comparative importance of sorting, evacuation and treatment of the sick and wounded will remain unchanged and will in the future, as in the past, prove the only solid foundation on which reliable medical services in the field can be established as the only means of carrying out the work of mercy among the all-too-numerous victims of our fratricidal wars.

Editorial.

REPORT OF THE MEDICAL RESEARCH COUNCIL FOR THE YEAR 1932-33.

In submitting their Report to the Lords of the Committee of the Privy Council for Medical Research, the Council point out the immeasurable loss they have sustained through the death of Sir Walter Morley Fletcher, which occurred on June 7, 1933. He had been their Secretary from the earliest days: first of the Medical Research Committee, formed under the terms of the National Health Insurance Act in 1913, and then of the Medical Research Council, placed under the direction of a Ministerial Committee of His Majesty's Privy Council, and incorporated by Royal Charter on April 1, 1920.

In their tribute to Sir Walter Fletcher, the Council state that "the gifts and character which were so influential in determining the policy of the Council in its early days, and which imparted so strong a momentum to the work of its maturity, will find in the continuing progress of that policy and that work their best and most lasting memorial."

The Medical Research Council received a Treasury Grant of £150,000 a year, which has since been increased to meet further development. They have an independent position and their sphere of action in promoting medical research is unrestricted by territorial or departmental limitations of function.

The Council are not merely an advisory body, but have full executive control of their funds and appoint their own administrative officers.

The Council point out that in the twenty years since the establishment of the Medical Research Committee, there has been a great change in the problems of medical research. Some diseases, such as chlorosis and epidemic diarrhœa and vomiting in children, have practically disappeared. Other diseases, as a result of scientific research, have been greatly reduced in incidence. Diabetes is no longer almost inevitably fatal, but is compatible with a comfortable existence if insulin and dietetic treatment are properly used. Rickets can be both prevented and cured. The prevention and treatment of tuberculosis have greatly advanced. The causes of oral sepsis are better understood; and the application of present knowledge should do much to prevent dental caries and periodontal disease. Just as the last century will ever be distinguished as the period when diseases, such as tuberculosis, sepsis, diphtheria and anthrax, were shown to be due to the invasion of the body by micro-organisms, so the present century will probably come to be remembered as the age of development of knowledge of metabolic disease. Modern knowledge of nutrition has been

revolutionized by the discovery of the probable structure and mode of action of vitamins.

The Council claim that the total amount of disability and the extent of human suffering have been immeasurably reduced by the combined efforts of investigators in all parts of the world during the period of its existence. They believe that with the fundamental knowledge which has been gathered, similar and greater progress will be made in subsequent years.

Recent research on anæmia is regarded as a great achievement. We know now that different forms of anæmia are cured by different substances, and that the formation of hæmoglobin and red corpuscles is dependent on specific chemical factors, including iron, copper, a water-soluble substance in the liver, an enzyme in gastric juice, and probably a part of vitamin B complex. It is probable that the liver active principle causes the conversion of the mother cells (megaloblasts) present in bone-marrow into the daughter nucleated cells (normoblasts), and that iron and copper are necessary for the actual manufacture of hæmoglobin and the conversion of the nucleated red cell into the granddaughter cell, the ordinary non-nucleated form. The enzyme hæmopoietine discovered by Dr. Wilkinson of Manchester in gastric juice (present in desiccated pig's stomach and in the stomach of carnivora, but not in that of ox or sheep) cures pernicious anæmia by acting on meat in the food; it then produces a substance, probably identical with the liver active principle, that converts the megaloblast of the bone-marrow to the normoblast.

Thus it seems probable that at every stage in the life of the red blood-corpuscle a particular chemical agent acts as a stimulant, and if this agent is absent the development process breaks down and a particular form of anæmia results.

The importance of experimental investigations upon the problem of influenza has been realized by the Council for a long time. They believed that an advance would be gained through greater knowledge of virus infections generally, and from experimental studies that were possible in apparently analogous diseases such as dog distemper. Some part of this expectation has been fulfilled in the course of recent work at the National Institute for Medical Research. Among domesticated animals available for experiment only the ferret has been found to share with the dog a high susceptibility to the virus of distemper. In the farm laboratories ferrets have been bred and kept under conditions precluding accidental infection. The sharp epidemic of influenza at the beginning of 1933 gave an opportunity of testing the suggestion, often made on epidemiological grounds, that the primary infective agent in this disease is also a filtrable virus. Dr. Laidlaw, Dr. Andrews and Dr. Wilson Smith took filtered washings from the nasopharyngeal mucous membrane of human patients, including two of themselves—after a diagnosis of influenza had been made; the washings

were filtered through "gradacol" membranes to eliminate bacteria, and the filtrates were tested on a variety of animal species available for experiment. The ferret proved to be the only animal susceptible to infection with these materials. The infection was conveyed only when the filtrates were instilled into the nostrils; injections by the needle proved ineffective. An infected ferret showed a characteristic febrile reaction, with two well-marked stages, and a nasopharyngeal catarrh. Filtered material from an infected ferret would similarly convey the infection to another. Recovery from an attack left the animal immune to further infection by the same virus; the duration of this period has not yet been determined.

There seems to be a relation between the virus of human influenza and that found by Shope, in America, in an epizootic disease of pigs described as hog-influenza. Shope found that in hog-influenza a virus, by itself producing but trivial symptoms, was associated with a bacillus allied to the bacillus of Pfeiffer, frequently found in cases of human influenza. The bacillus, however, was incapable of producing the severe disease in epizootic form. Only when the virus and the bacillus were allied was the severe and naturally spreading disease produced. A strain of the hog-influenza virus, supplied by Dr. Shope, has been found to produce in the ferret a condition practically indistinguishable from that caused by the virus from human cases of influenza. Further, a ferret which recovers from infection by the swine virus seems to be immune to the human virus, while recovery from the human virus produces a substantial, though not complete, immunity to the swine virus. The Council consider that further work will be required before it is established that this or a similar virus is the cause of the recurring outbreaks of influenza. But at any rate a starting point has been made, and the disease has been brought within the range of experiment.

Work on the unit dimensions of viruses has been continued and the measurements arrived at by Dr. Elford's method of differential filtration through graded collodion membranes appear to correspond with those of the optically demonstrable elementary particles obtained by direct measurement of Mr. Barnard's ultra-violet photomicrographs. Such comparative measurements have been made for the viruses of vaccinia, fowlpox and ectromelia.

Mr. Galloway has investigated the vesicular stomatitis of horses and cattle, which resembles foot-and-mouth disease, but is distinguished by the usual distribution of the lesions and the infectivity of the stomatitis for the horse. Dr. Elford's filtration experiments suggest that the infective units have a diameter somewhere between 70 and 100 millimicrons. Such units would be just on the limit of critical resolution by the shortest ultra-violet wave-length, and Mr. Barnard has been able to detect very minute particles of uniform size in the fluid from the vesicles of vesicular stomatitis and to obtain photographs which indicate that the particles are

within the limits determined by filtration. But for such measurements the virus would be considered as closely allied to the virus of foot-and-mouth disease, of which the infecting particles are still far beyond the range of optical detection and are estimated by filtration to have a diameter of only ten millimicrons—only a small multiple of that of an ordinary protein molecule.

A gap still remains between the viruses with the smallest optically demonstrable particles and those with a fineness of dispersion approaching that of a protein in solution. But this gap is being filled by the range of dimensions of units of the virus-like bacteriophages.

Dr. Burnet has attempted a classification of bacteriophages based on their antigenic properties, on the size of their active units, on their action on cultures, and on their physico-chemical properties. A series of bacteriophages acting on the dysentery-coli group of bacilli has been subjected to these tests and eleven groups have been clearly separated by their antigenic properties, as determined by specific antisera. The members of any one such serological group were found to show a set of common reactions to the other tests, while members of any other group showed similarly a common but different combination of the other characters. While this further evidence gives support to the conception of the bacteriophages as independent transmissible agents analogous to the viruses, it is incompatible with D'Herelle's view of them as mere variants of a single plastic species of ultra-micro-organisms. They must be regarded, rather, as a whole group of agents infecting the bacteria, and comparable to a whole range of the separate viruses infecting the higher animals.

Other immunological reactions have been observed with bacteriophages having relatively large particles. These were found to be rapidly adsorbed on the surface of bacteria sensitive to their action; the bacteria then lost their sensitiveness to the agglutinating action of their own specific anti-bacterial sera, became agglutinable by anti-sera for the adsorbed bacteriophage, and removed antibodies for the bacteriophage from solution. Another set of experiments showed the possibility of removing the particles by filtration and with them their bacteriolytic action, leaving in the filtrate substances still capable of reacting with the specific antisera, in a manner analogous to that of the soluble "haptenes" separable from ordinary bacteria.

These properties of the bacteriophages resemble those more easily demonstrated on the visible bacteria and this analogy is rendered more complete by the fact that in a mixture of a strong suspension of a large particled bacteriophage with a potent antiserum, aggregates appear which are visible to the naked eye. Filtration experiments assigned to the active particles of such a bacteriophage a diameter of fifty to seventy-five millimicrons. Mr. Barnard has succeeded in obtaining photographs of those aggregates, showing them to be studded with refractive uniform particles of about the size expected, but too small for accurate measurement.

The Council think that all this newer evidence strengthens the conception of the bacteriophages as infective agents organized into extremely minute particles, and as comparable in many ways to a series of recognized viruses.

Dr. Perdrau and Dr. Todd found that bacteriophages could be inactivated by methylene blue in the presence of light and free oxygen, and they have applied this photodynamic process to the virus of canine distemper. A ferret which had been given a single injection of the inactivated virus showed no symptoms of infection and acquired a high degree of immunity to the corresponding virus in its actively infective condition. This immunity appears to last beyond the period over which it has so far been possible to test its duration. Later tests with dogs, which are still in progress, indicate that they also are efficiently protected by a single small injection of the virus inactivated by this method. The vaccine is prepared from a cell-free suspension of the virus, causes much less local reaction than the formolized emulsion hitherto used, and can be dried, to preserve its stability, without apparent loss of its immunizing potency.

The photodynamic process has proved ineffective in foot-and-mouth disease, the virus of which is very resistant to inactivation, and in vaccinia, the virus of which is easily activated, but yields a product poor in immunizing power.

The Council state that the recorded increase in the incidence of primary cancer of the lung, in recent years, has aroused speculation as to a possible connection with tarring of the road surfaces, leading to the distribution in the air of dust particles containing tar, a substance known to produce skin cancer after prolonged superficial application. Other speculations have concerned themselves with the effects of constant exposure to traces of petrol, motor-exhaust gases, etc.

It was thought that by the use of small animals, with their short span of life and correspondingly rapid rate of vital processes, it might be possible to submit these conjectures to experimental test. Dr. Argyll Campbell, who has for some years been investigating the effects on mice of prolonged exposure to abnormal but not immediately fatal gas-mixtures, has begun an experiment in which mice are continuously exposed to scattered dust from tarred roads. By a similar method he is testing the effects on mice of different constituents of the exhaust gases from motor vehicles, which are breathed by the animals in concentrations adjusted to resemble those to be expected in a modern, traffic-crowded street. Such experiments, to justify conclusions from negative results, must be continued for the full time allowed by the span of the mouse's life, i.e. about two years; but the effects obtained in that period may be reasonably regarded as comparable to those to be expected in some fifty years of the life of a man. So far as the experiments have gone, positive evidence of harmful effect has been found in the appearance, in a high proportion of the mice exposed to tar

dusting, of skin warts resembling those produced by the direct application of tar, and showing a tendency to become malignant and to produce metastatic growths in various organs. The question whether primary cancer of the lung is also produced by prolongation of the treatment still awaits decision.

For ten years the Department of Clinical Research, University College Hospital, London, has been following up the after-histories of ex-Service patients suffering from heart disease and has now completed its work. In 1917 the Medical Research Committee issued a report in which was described a system of diagnosis and prognosis in the grading of soldiers suffering from derangements of the cardiovascular system. As regards prognosis, the essential idea was that the subsequent course of the patients is to be foretold not so much by the presence or absence of signs of valve disease, or by the type of valve disease present, but rather by the degree of cardiac enlargement and the grade of cardiac failure. In order to test the soundness of these views two groups of cases were followed. One group included over 600 men suffering from effort syndrome, but without definite signs of cardiovascular or other disease. The report on this group, followed up for five years, was published in 1925. The other group, followed up for ten years, comprised 1,000 men with definite signs of acquired cardiovascular disease, and a full report on this group has just been published by Dr. Grant. The great majority of the men in the group were sufferers from disease of the valves of the heart. A striking feature of their after-histories is the large proportion of men, especially those with uncomplicated valve defects, who lived throughout the ten years uneventfully and without any change in their physical signs: 51 per cent of the 1,000 men remain alive. Those who die within the period show no steady progression to a fatal termination: the original condition remains stationary year after year until death occurs suddenly, or until an intercurrent infection, or the onset of auricular fibrillation, leads to the development of congestive failure and death within a relatively short time. Recognizing and keeping within their limited tolerance the majority of patients make no complaint and lead comfortable if not active lives.

Prognosis is most satisfactory when based on cardiac enlargement and cardiac failure. The recognition of the type of valve lesion gives but little aid in prognosis. This is least favourable in aortic stenosis and syphilitic aortic regurgitation, but there is no material difference in the death-rates among those with non-syphilitic aortic regurgitation and those with mitral stenosis, or those with these lesions combined. The study shows that the outlook for patients suffering from valve defect is not so bad as is generally thought, and that in a large number of cases the fear of an early death aroused by the diagnosis of heart disease can be confidently allayed. Thus, in the case of valve disease with little or no cardiac enlargement and good or fair exercise tolerance, four-fifths survive the ten-year period.

Clinical and other Notes.

A CASE OF ACUTE LOCALIZED INFLAMMATION OF THE SMALL INTESTINE.

By Lieutenant-Colonel C. M. FINNY, O.B.E.,
Royal Army Medical Corps.

The following case seems worth publishing, as I have been unable to find in surgical literature any account of a similar condition, with the exception of a case published in the *British Medical Journal* of October 29, 1932, by Mr. Nash:—

Lance-Corporal S. was convalescent in hospital after an operation on his knee on October 2. The wound was healed.

On October 10 he complained of general malaise and anorexia. His tongue was furred and his evening temperature 100° F.; pulse 80.

On October 11 he began to vomit at 7 a.m., and continued to vomit even water throughout the day. There was some epigastric pain, but no tenderness, rigidity or distension. His bowels acted after two enemata. Temperature and pulse-rate were normal.

October 12: He had not vomited since the previous night, but had slept very little and felt sick and tired.

His bowels acted three times spontaneously—small, rather loose stools—but in the evening he had a drawn worried look and complained of severe colicky pains. There was slight tenderness all over the abdomen, particularly in the epigastrium. There was no distension and the abdomen moved on respiration, but the recti were on guard, particularly in the upper half. Temperature was 98·6° F., and pulse 96.

October 13: After a better night's rest he felt more comfortable, but his respiration was definitely thoracic and the abdomen was slightly distended.

He complained of some pain on micturition and there was definite tenderness on rectal examination.

There was still pain and tenderness above the umbilicus. The leucocyte count was 13,400.

In view of the increasing local signs, an operation was advised. On opening the abdomen by a right paramedian incision several pints of clear serous fluid escaped.

The first coils of small intestines seen were collapsed, but otherwise normal in appearance. A brief search revealed a coil of enlarged and acutely inflamed bowel. This was found to be fixed. It was traced upwards and was found to be held in the epigastrium by recent adhesions to the great omentum, which was wrapped round it. The adhesions were easily

separated with the finger and the inflamed bowel was brought to the surface. For a distance of nearly three feet the small bowel looked like a coil which has been bathed in the pus of an acute pelvic peritonitis. It was crimson with a velvety surface, but showed no signs of gangrene or ulceration. It was not distended, but to the touch gave the sensation of a great thickening of its walls. The inflamed portion shaded off into normal bowel, rapidly at one end, more gradually at the other, where there were scattered hæmorrhagic areas in the otherwise normal bowel wall. The adjacent mesenteric glands were enlarged and soft and the mesenteric vessels were pulsating.

There was no evidence of disease in the stomach, duodenum, gall-bladder or appendix, and no sign of perforation in the inflamed area.

It was a striking picture—the violently inflamed loop in an otherwise normal abdomen.

There were no bands or adhesions beyond the recent ones to the omentum.

As the inflamed bowel was living and from the previous symptoms not causing complete obstruction, it was not interfered with and the abdomen was closed without drainage.

October 14 : The bowels acted twice spontaneously in the evening. The stools contained some blood but no pathogenic organisms.

He was kept on rectal glucose saline for forty-eight hours and gradually returned to normal diet.

All pains disappeared in a few days and convalescence was uneventful. The wound healed without any suggestion of infection. At no time was there any sign of purpuric spots or joint inflammation.

I find it difficult to explain the ætiology of the above condition. The patient was in a ward partaking of the same food as other convalescents. This, coupled with the sharply defined localization of the inflammation and the negative bacteriological examination of the stools, appears sufficient to exclude the ingestion of a chemical or bacteriological poison as the cause.

There was no torsion or strangulation of the affected loop ; the adhesion of the omentum was obviously secondary to the inflammation. The branches of the mesenteric artery supplying the affected loop were pulsating.

In India access to surgical literature is limited, and I have been unable to find any account of spontaneous recovery from a mesenteric thrombosis. But the appearance in this case suggests this condition in a branch of the superior mesenteric vein, the usual disastrous effects of which were overcome by a satisfactory collateral circulation.

EVIPAN SODIUM INTRAVENOUS ANÆSTHESIA.

A Report on Fifty Trial Cases.

By Major K. P. McKENZIE,
Royal Army Medical Corps.

I was privileged by the War Office to try out this new preparation of Bayer Products, Ltd., for short anæsthesia. The first administration was carried out on August 5, 1933, and this barbiturate has since been used for all short operations at the Royal Victoria Hospital, Netley.

The fifty trial cases were made up as follows:—

Tonsillectomy, antrostomy (maxillary) and drainage of frontal sinuses, turbinotomy	37 cases
*T.B. abscess sternum (removal of sequestrum and drainage)	1 case
Cyst chest (cysticercus). Excision	1 case
†Sebaceous cyst (supra-orbital). Removal	1 case
Groin abscess. Incision and drainage	1 case
Varicocele. Radical cure	1 case
Necrosis, terminal phalanx, index finger. Removal	1 case
Multiple fractures inferior maxilla. (Extraction of teeth and taking dental impressions)	2 cases
Foreign body hand (steel wire)	1 case
Incomplete abortion. (Dilatation and curettage)	1 case
Perineal cyst. Excision	1 case
Cystoscopy	1 case
‡Sigmoidoscopy	1 case
Total	50 cases

Six cases were not prepared in any way prior to the operation; some of these had breakfast as usual.

Six cases (tonsils and adenoids) were given $\frac{1}{100}$ to $\frac{1}{75}$ grain atropine twenty minutes prior to operation.

Six cases were given alopon $\frac{1}{6}$ grain + scopolamine $\frac{1}{300}$ grain one hour prior to operation.

Six cases were given alopon $\frac{1}{3}$ grain + scopolamine $\frac{1}{150}$ grain one hour prior to operation.

There was only one failure; case marked * and this patient had on a previous occasion been given N_2O and was found to be gas resistant. The operation was carried out, however, by the addition of $N_2O + O_2$.

The case marked † was operated upon under percaine spinal anæsthesia for an inguinal hernia, and at the termination was given evipan sodium, ten cubic centimetres. There was no subsequent fall in blood-pressure nor any effect on respiratory function and he made a normal recovery.

The case marked ‡ had, in addition to $\frac{1}{6}$ grain alopon + $\frac{1}{300}$ grain scopolamine, twenty minims of tinct. opii. by the mouth a few minutes before coming to the theatre. This case remained anæsthetized for a period of forty minutes.

In three of the cases an additional anæsthetic was contra-indicated: one was a case of active tuberculosis of the lungs with a dry cough, and two were multiple fractures with displacement of the inferior maxilla with septic mouths, œdema of the tongue, lips and neck, owing to contusion and hæmorrhage.

The smallest dose given in this series was 5 cubic centimetres and the largest 12 cubic centimetres. One case was given 5 cubic centimetres as an initial dose and a further 5 cubic centimetres at the expiry of seven minutes with a satisfactory prolongation of anæsthesia.

A few notes on evipan sodium may not be out of place :—

Evipan sodium is the sodium salt of N-methyl-C-C-cyclo-hexenyl-methyl barbituric acid and dissolves freely in water, but this watery solution is not stable after an hour or so. It is another member of the group of barbituric compounds of which veronal, luminal, phanodorm and prominal are members; some noted for their narcotic and sedative action, others for their anti-epileptic action. The action of evipan sodium by intravenous injection seems to open up a new path for investigation as to the nature of anæsthesia, whether blood-borne by action on nerve cells, by virtue of fat or water solubility. It is a well-recognized fact that the effects of the barbiturates depend on their fat and water solubilities (Overton and Mayer). The action of these drugs is not considered to be a chemical one as they are too stable to undergo a chemical change in the short period preceding narcosis. The ratio of fat and water solubilities is known as the partition co-efficient "K" which measures the ratio of the concentration in the blood and in the fat of the nerve-cells. The pharmacological action is considered to be physical in kind, that is to say, absorption by the cell wall with consequent interference with normal cell functions. This co-efficient "K" is only an indication of the type of the narcosis produced, the quantitative effect depends upon the rate of destruction or elimination of the drug.

Dosage.

The regulation of dosage, as outlined in the "Technique of Evipan Sodium Narcosis" recommended by Bayer Products was followed in the first 15 cases : viz., exact observation of the patient during the injection and maintaining a constant rate of injection (one cubic centimetre in fifteen seconds) till the patient falls asleep and then injecting a further similar amount ; that is to say if the patient falls asleep after 4 cubic centimetres then a further 4 cubic centimetres are injected making a total of 8 cubic centimetres. With subsequent cases observation of a constant rate of injection was not followed as it was found that a deeper and better anæsthesia was obtained by injecting the full 10 cubic centimetres in forty-five to sixty seconds, thereby ensuring a full fifteen to twenty minutes perfect anæsthesia. The patients are instructed to commence counting slowly aloud when they feel the needle prick and most cease before 45 is reached. Some go as far as 9 or 10, others between 30 and 40, and a

few got to 55. A closed gag is placed between the teeth just before the injection into the vein is made. Soldiers and airmen require more than women or ordinary civilians, and it is for this reason that I have asked Messrs. Bayer if ampoules of 1·5 grammes of the powder could be supplied and would mix satisfactorily in the 10·5 cubic centimetre ampoules of distilled water. There would then be no necessity to prepare a second ampoule or to have to refill the syringe during an injection. No children have been anæsthetized in this series.

Remarks.

Evipan sodium for intravenous anæsthesia is an excellent anæsthetic for operations that can be completed in fifteen minutes with certainty. The rapid onset of the anæsthesia, the simplicity of administration, the absence of any after-effects, and the great saving of time in induction should make this most recent barbiturate useful to dental surgeons, gynæcologists, and surgeons in military or civil practice where a short anæsthesia is required.

The rapidity of onset of complete anæsthesia is dramatic, some patients literally count themselves out. The onset of anæsthesia is signalled by a yawn, then a snore, and the anæsthetist has only to keep the airway clear by supporting the lower jaw and keeping the tongue from falling back into the pharynx. The period of anæsthesia varies with the dosage, but with an ordinary dose of ten cubic centimetres a full fifteen minutes can be relied upon provided no asphyxial symptoms have been allowed to occur prior to the commencement of the operation.

It is well to wait for two minutes after dissolving the powder in the ampoule with the distilled water to ensure solution and it is advantageous to wait for a minute or two after the injection has been completed if the patient is not fully relaxed.

The evipan sodium as supplied by Bayer Products Ltd., Africa House, Kingsway, London, W.C.2, is issued in powder form in ampoules of 1 gramme with an ampoule of 10·5 cubic centimetres distilled water. The powder is dissolved by adding 10 cubic centimetres distilled water by means of the syringe, and by emptying and refilling once or twice it becomes completely dissolved and ready for injecting. Any suitable vein is selected and the injection given as already described. It is better to have an assistant to hold the arm and forearm steady as occasionally the patient may twitch or move before the injection is completed.

Effects and After-effects.

There is a slight quickening of the pulse-rate but this is only transient, the blood-pressure falls slightly for a short period and the respirations are less deep to begin with but gradually return to their normal depth. Slight twitching of the facial and other muscles has occurred in some cases, and jactitations of the limbs (upper and lower). The degree of muscular

relaxation varies. The pupils are dilated but react to light and the corneal and conjunctival reflexes disappear when full anæsthesia is reached.

In no case so far has there been any serious respiratory depression and the patient's colour has not altered. There are no unpleasant after-effects and the drug is rapidly detoxicated by the liver. It has been stated that a rabbit can decompose half the narcotic dose in thirteen minutes. There is no disturbance of the patient's mental state after the operation.

All the patients stated that they could not remember anything after the first prick of the needle and were quite unable to remember the number to which they counted. As evipan is not a volatile anæsthetic like ether the narcosis must be regarded as non-controllable but owing to its rapid detoxication by the body it is almost brought into line with a controllable anæsthetic. As in the case of many other anæsthetics when pushed too far, the respiration is the first system to be affected. Many of the cases in this series had been anæsthetized in other ways in other hospitals but all agree that they will ask for evipan in the future for short operations.

I am again greatly indebted to Major-General J. W. West, C.M.G., O.B.E., K.H.S., for his help, interest and valuable suggestions in the compilation of the report.

Travel.

ULM-VIENNA, 1900.

By Major OSKAR TEICHMAN, D.S.O., M.C., T.D.

The Easter term was nearly over and we were in training for the Mays. It had been a good term, in those halcyon days when summer was always summer. Edward and I were sitting in his rooms above the eternally-closed great gate of Caius, discussing plans for a holiday abroad. Below us the King's Parade shimmered under the midday sun, and the horses in the hansom rank stood listless and apathetic. The raucous cry of a passing newsboy proclaimed that Lord Roberts had entered Pretoria; but this news left us cold as Mafeking had been relieved a few weeks previously and been followed by a gigantic bonfire in the Market Place fed with the shutters of long-suffering Cambridge tradesmen. For weeks we had been keyed up to a pitch of excitement by the siege of Mafeking, as evinced by the rustle of newspapers during our daily ten o'clock lecture—and now the occupation of Pretoria was somewhat of an anti-climax.

"I should like to explore one of the great rivers of Europe," remarked Edward.

Various rivers were discussed. The Seine was too short, the Rhone too rapid, the Volga too far away.

"What about the Rhine?"

"The Rhine has already been explored by the Kickleburys," remarked Edward, adding that he would prefer a river unfrequented by tourists.

"What is wrong with the upper reaches of the Danube?" I asked.

Edward opened his piano and played a few bars of the "Blue Danube." He ceased playing and then suddenly declaimed "*Cedere Danubius se tibi, Nile negat,*" so that settled it.

A few weeks later we arrived at Ulm and we commenced to make inquiries about our proposed trip of some five hundred miles to Vienna. We were considerably helped by the fact that my brother had made the journey with an Oxford friend some years previously; so we knew where to go for local information. Inquiries for Herr Anton Mollfender, the last of the old Danube pilots, elicited the information that he was usually to be found at the Gasthaus zum Schiff in the Donau-Gasse. It did not take long to find this ancient hostelry nestling against the town wall by the Danube, and close to the gate whence Mack's army had marched out after surrendering to Napoleon. Nearby a cannon ball, partly embedded in the wall, reminded us of the brief investment of Ulm.

On inquiring for Herr Mollfender, we were told that he always took his glass at midday, so, after ordering a litre of *Tiroler*, we seated ourselves in the *Weinstube* and waited for the great man.

Suspended from the ceiling was a model of a Danube ship, black with age, such as used to carry merchandise down to Vienna, and even as far as the Black Sea. This so-called *Donauschiff* consisted of a very broad, flat-bottomed boat with a wooden hut built on it, somewhat resembling a Noah's Ark. Some interesting old coloured prints attracted our attention; especially one of an individual dressed in white tunic and knee breeches, red epaulets and green hat, holding a sort of wooden trident, described as a *Weisfischer*. While arguing as to the meaning of this word, an aged man entered the room, accompanied by the inn-keeper. Anton Mollfender, with a large beaky nose and completely bald, rather resembled a vulture, but there was a twinkle in his keen blue eyes; and although well on in the eighties he carried himself erect. Dressed in a suit of black broadcloth, with a heavy gold chain across his waistcoat from which hung an enormous bunch of seals and a gilt anchor, he was evidently a man of importance, as shown by the respect accorded to him by the other occupants of the *Weinstube*. He gave us the customary "*Grüss Gott*" as he passed our table, but mine host motioned him towards us, at the same time explaining the reason for our visit to the Gasthaus zum Schiff. As the old man seated himself at our table, his wrinkled old face became quite animated.

"Well, this is most interesting, so the *Hochwohlgeborene Herren* intend to make the journey by boat to Vienna. Since the river trade ceased nigh forty years ago I can only remember two other parties making the journey from Ulm for pleasure."

The old man paused and emptied his glass of *Tiroler*. We plied him

with numerous questions, but although we possessed a fair amount of German between us his Suabian accent, particularly when he got animated, was difficult to follow. Every now and then I saw Edward write a word down for future reference to his dictionary. We gathered, however, that until the sixties, when the railway finally captured all the trade, there was considerable traffic in wine, silk, paper and raw hides, which were shipped down the river to Vienna and beyond in boats similar to the one which was hanging from the ceiling. Old Anton used to build these boats which, on arrival at their destination, were sold or broken up as the Danube was too rapid for any boat to return upstream to Ulm. Timber, as to-day, was also floated down stacked on rafts. He told us harrowing stories of the *Strudel* (or whirlpool) at Grein, which in his lifetime had, by blasting, been rendered safe for the passage of ships. He added, however, that even now this sudden turn in the river, which then flowed over treacherous and ragged rocks, had to be negotiated with skill.

"And what about a boat?" asked Edward, speaking slowly in his best German.

Herr Anton Mollfender scratched his head and then, as if he had received a sudden inspiration, he exclaimed, "I know a friend who would sell you a *sand-ziller*, but it will be expensive."

"What is a *sand-ziller*?" I asked, "and what will it cost?"

Anton gave me a deprecating glance, he was surprised at my ignorance.

"The name explains itself," he replied, somewhat shortly. "Naturally, it is a boat used for getting sand or gravel out of the bed of the river; it is about ten metres long, flat-bottomed, and it will cost you twenty marks."

Edward and I looked at one another in astonishment at the idea of obtaining a thirty foot for a pound! Herr Mollfender, misunderstanding our expressions, hastily added, "But although the boat will cost you dear, you should get twenty kroners for it in Vienna."

This sounded almost too good to be true, for at the current rate of exchange the use of the boat for about ten days would be three shillings and sixpence! After obtaining the name and address of the man who would sell us the boat—he turned out to be Herr Mollfender's son—we were about to leave the inn when the oracle spoke again:

"Will the *Herschaften* pray be seated and order another bottle of wine, for there is yet an important matter to discuss. It is as to the boatman who will accompany you."

"Why do we need a boatman?" asked Edward.

"For three very good reasons," replied Herr Mollfender, counting them on the fingers of his left hand as he spoke. "Firstly, because you may not find your way without a guide as in some places the Danube divides up into many channels, and before you know where you are you may be a mile wide of the main stream and aground; there is a scheme to canalize the main river but up till now this has only been done lower down. Secondly, without a man you may have the boat stolen at night, for there are

some queer fellows down there," he pointed vaguely towards the Orient. "Thirdly, because it is not seemly that the *Herrschaften* should travel without a servant."

"He is quite right," chimed in mine host; "Herr Mollfender knows what he is talking about; he has spoken."

After this dissertation we felt that there was no further room for argument.

"Where shall we find a suitable man?" I asked.

"He is already found," replied the oracle; "he is my nephew Eugene Kastner; he has often helped to float rafts down to Vienna. He will be paid three marks a day and his return fare to Ulm. He lives in the Fischer-Gasse close to the town wall, and he is *nüchtern*."

Considering the matter settled, Herr Mollfender rose from his seat and shook hands with us. As we parted at the inn door he gave us one more piece of advice, in a stage whisper:—

"Do not sit late in a *Weinstube* in Lower Bavaria, for there the peasants when flushed with wine have a curious custom of suddenly putting out the lights and drawing their knives! The wise man then gets under the table, but even then he is not too safe!"

The same evening we met Eugene at the Rothe Ochse by appointment. He was rather a taciturn middle-aged man who became more talkative as the evening went on. He consumed vast quantities of white beer, brown beer and radishes, and then informed us that it was essential, in order to ward off the ague, to finish with a few glasses of cherry brandy. Finally we parted from a very talkative Eugene, whose German became more and more Suabian until at last it was quite unintelligible. We did, however, gather that we were extraordinarily lucky to have obtained his services, and that he was the best *schiffahrer* between Ulm and the Euxine.

"By the way," said Edward, as we were about to turn in, "what did old Mollfender mean when he said that Eugene was *nüchtern?*"

Stifling a yawn, for it was nearly midnight, I looked the word up in our pocket dictionary. "It means abstemious, sober, temperate!"

"*Das ist mir schnuppe,*" remarked Edward (he was rather proud of having picked up the idiom during the day), "and in any case he won't lose himself or our boat on three marks a day!"

Two days later we embarked in our *sand-ziller* and pushed out into the rapidly-flowing Danube, amidst the cheers of the fisher folk, amongst whom stood Herr Anton Mollfender, waving an antiquated bowler hat.

In the bows we flew a small pennant of black and light blue, and in the stern a Union Jack. It was a roomy boat and stoutly built of rough timber. Amidships a large oar was lashed to an upright stay, and in the stern was fixed another oar for steering. Lower down the river, when the current became slower, one of us, in order to assist the helmsman, propelled the boat with the oar like a Thames lighterman—but at present this was not necessary. The stern of the boat was covered with a few boards under

which our luggage, spirit lamp, crockery, fishing tackle and cushions were stored. As we dropped down the river the great spire of the Cathedral glistened in the morning sun, and the old town wall stood out boldly against the piled up jumble of red roofs.

The Country before us had the appearance of a vast plain here and there interrupted by a hamlet or wooded hill. On our left lay the heights of Elchingen, whence the "Bravest of the Brave" derived his ducal title in 1805.

A couple of miles lower down we noticed that Eugene was steering the boat towards the right bank of the river and before we could stop him the boat had grounded on the shingle.

"We don't want to get out yet"! I cried from the bows, "What have you stopped for?"

"Snails!" retorted Eugene.

Completely mystified we asked him what he meant.

"Yonder lies Leipheim where the *Herren* may obtain the best snails in Bavaria—you have a spirit lamp and saucepan on board, and I will make you an excellent snail soup for your *mittagessen.*"

It was a disappointed Eugene who pushed off again into mid-stream and for the next half hour he never uttered a word.

We had now entered the Donau-Moos or fen country which abounded with game, especially a variety of small roe-deer, some of which we saw scampering away on the approach of our boat. A question put to Eugene about these deer elicited only a grunt, he was still sulking over the snails. After a refreshing bathe, we merely dropped overboard and floated down behind the boat, lines were thrown out baited with sausage; and in a short time some fish (which looked like perch) was secured. These with an omelette made by Eugene made an excellent lunch.

As we were by this time approaching Höchstädt we landed on the left bank and made our way up through the marshes to the little town. Meanwhile Eugene took the boat on with orders to meet us at the wooden bridge on the Danube near Blenheim. A walk of some three miles brought us to Blenheim, crossing on the way the ground where Tallard was encamped the day before the battle. Eastwards we could see Tapfheim and its church spire where Marlborough and Eugene with their telescopes had discovered the enemy. Although we found no "Old Caspar" to act as guide it was not difficult to reconstruct the chief features of the battle: but it was rather disconcerting to cross the famous Nebel brook by a single plank! On rejoining our boat we told Eugene where we had been. He had heard of the battle of Höchstädt also of "Malbruk" and Eugene; and he remarked naïvely

"We Eugenes have always been fine fellows!"

That night we lay at the Krone in Donauworth; under the heights of the grim Schellenberg.

Swimming next morning behind our boat we suddenly became aware

that the water was much colder. Eugene called out that we had been joined by the Lech, which comes down through Augsberg from the Tyrol.

"Passage of the Lech," spluttered Edward as he climbed shivering aboard, "where stout old Tilly was killed."

We went ashore at Oberhausen to visit the monument of La Tour d'Auvergne, the "First Grenadier of France." Edward, whose fund of historical ancedote seemed endless, knew all about this "second Bayard." How he had sacrificed rank in order to be considered the first Grenadier of France; and how after falling at Oberhausen his sword had been hung in the church of the Invalides, and his heart borne in a silver box attached to the standard of his regiment—at every roll-call his name was mentioned —"La Tour d'Auvergne mort au champ d'honneur."

At Neuburg we landed near the old Ducal Palace, but we were refused admission by a truculent Bavarian sentry. Eugene, who like most Suabians hated the sight of a light blue uniform, reminded us that we were no longer in Wurttemberg and that we could hardly expect good manners down here. We discovered afterwards that the Palace was used as barracks and agreed that the sentry was only doing his duty.

In the old fortified town of Ingolstadt we stayed at the Wittlesbacher Hof, a comfortable inn, but rather more expensive than at Donauworth—room 1 mark, dinner 1.50, breakfast 50 pfennig, total about three shillings each.

Next morning after visiting the Tilly monument in the Frauenkirche, we waited impatiently for Eugene to carry our bags down into the boat. At last he came, a rather sorry sight with one black eye.

We asked him whether he had met with an accident. The only reply he vouchsafed was that these Ingolstadters were "*böse buben.*"

"Remember that Mollfender guaranteed that he was *nüchtern*, so it can't be his fault," said Edward.

Eugene was very silent as we floated down the river past the castle of Vohburg and the wooded slopes of Heinheim. Soon we entered a gorge, whose perpendicular wall of grey limestone rose some four hundred feet from the water's edge. At intervals we noticed iron rings fixed to the cliffs, which were used formerly for pulling boats up stream. The river had narrowed considerably and the pace increased as it rushed round sharp corners.

"Out with the lines for this is good water for fishing!" called Eugene.

And in ten minutes we had caught enough fish for lunch. Suddenly as we rounded a corner the monastery of Weltenberg, partly restored, appeared on an open space between the river and the almost perpendicular cliffs.

Lost in admiration our silence was interrupted by Eugene who uttered the one word "Beer" as he steered the boat ashore—and excellent it was, ice cold from the vaults of the monastery now a restaurant.

As we approached Kelheim the cliffs became less severe and more wooded. Up on the left we had a view of the famous Befreiungs-Halle,

opened on the fiftieth anniversary of the battle of Leipzig—an enormous rotunda surrounded by collossal figures representing the States of Germany.

At Kelheim we landed at the Donauthor, while Eugene carried our bags up to the Ehrenthaller inn.

It was warm work ascending the road to the Befreiungs-Halle, whence we had a magnificent view of the Danube winding through open country towards Regensberg, and also of the Altmühl Thal and Ludwig's Canal which connects the Main with the Danube (and hence the North Sea with the Black Sea).

On leaving Kelheim next morning we floated, and bathed, leisurely towards Regensberg which was only about twenty miles away. Gradually the fertile plain, which we had observed from the Befreiungs-Halle, gave way to low hills on either side of the Danube.

At Regensberg we landed above the old bridge and put up at the Goldenes Kreuz near the street of the Ambassadors. Having arrived in the early afternoon we had plenty of time to explore the mediæval town including of course the Cathedral, the Hall of the Imperial Diet and the subterranean dungeons and torture chamber beneath it.

Before leaving next morning we went with Eugene to inspect the bridge through which we were to pass. It was a case of selecting your arch. Owing to the current the water was piled up against the buttresses, and on the other side some old piles had to be avoided. So great was the rush of water through these arches that no boat could pass through them from below upwards.

We were inclined to agree with the remark made by Napoleon—"*Votre pont est très desadvantageusement bâti pour la navigation.*"

However we shot the bridge with ease, avoided the piles and soon found ourselves clear of the town. At Donaustauf we landed and climbed by a footpath to the Valhalla, a gigantic Greek Temple erected some seventy years ago as a national temple of fame for Germany. From the steps outside the Valhalla we had a good view of the Bavarian Forest, the Danube to Straubing and the distant Alps.

Hungry and thirsty after our climb we ate a hearty lunch washed down by some bottles of excellent Regensberger.

Assured by Eugene that there were no rocks or bridges for many miles, we all three took our afternoon siesta; and we did not wake up until many miles lower down the Danube, when the boat went aground with a bump near Pfatta—and lucky it was, as at this point the river divided in numerous channels with troublesome shoals. On our left Eugene pointed out the beginnings of the Bavarian Forest, and on the right the fertile plain which constitutes the granary of Bavaria. Eugene, who used to have an uncle living in this district, became very enthusiastic over the fertility of this so called *Dunkelboden*, once a morass which had been drained leaving rich black earth. He told us that the peasants of the district were very prosperous and contented. As we approached Straubing the river took on

a most tortuous course. Several times we thought that we had reached the town, when an unexpected turn would take us away again.

We found Straubing a beautiful old town, little spoilt by the modern builder. The Danube did not originally run under the walls of the town. In the late middle ages the inhabitants by damming the stream altered it to its present course.

After shooting the old stone bridge, against the buttresses of which the water was piled up to a considerable height, we made our way to the Schwarzer Adler, a very comfortable hostelry.

Next morning, leaving Straubing behind us, we floated down still between the Bavarian Forest and the *Dunkelboden*. As we were bathing at the time, we did not stop at Ober-Altaich although Eugene wanted us to visit the Benedictine Monastery in order to see the frescoes, which he said included one of Luther riding on a pig with a Bible in one hand and a glass of beer in the other.

The round castle of Bogenberg close by reminded. us of the robber castles on the Rhine.

At Metten, where a small stream joined the Danube, we caught a little pike which, in spite of Eugene's remark that *Hecht* was excellent boiled in milk, we threw back into the river.

At Deggendorf, the scene of one of Pandour Trenck's exploits, we purchased wine at the Drei Mohren.

A mile below Deggendorf our boat suddenly quickened its pace, as a considerable river came rushing down to join us on the right.

"Campbell was right," said Edward consulting the map, "the Isar is flowing rapidly!"

That night we slept at Hofkirchen a hamlet on the edge of the forest. In the *Weinstube* of the inn we noticed that most of the guests, instead of smoking cigars, took snuff from little glass bottles which they carried.

Next morning we floated through the hills of the Bavarian Forest amidst magnificent scenery.

At the walled town of Vilshofen we went ashore to buy eggs and sausages. On returning to our boat we found Eugene having a wordy argument with a red-bearded ruffian. As the Bavarian patois was quite unintelligible to us, I asked Eugene what it was all about.

"This *Lumpengesellschaft* proposes to pilot our boat through the rocky passage between Vilshofen and Passau. He would show Eugene Kastner how to do it—Eugene than whom there is not better *schiffahrer* between Ulm and the Black Sea. He says that since the Danube traffic ceased, few know this dangerous stretch of the river. That may be true, but I am one of the few. I have often been down on a raft—and as a matter of fact with our shallow draught there is absolutely no danger."

We prepared to embark, but the "beaver" buttonholed Edward repeating the word *gefährlich* several times. Edward nodded and, to close the conversation, took a sausage out of his paper bag and presented it to him with a low bow.

As the stream carried us on our journey we looked back at Vilshofen where on the quay stood a solitary beaver eating his sausage like a banana.

The river now became much narrower, its rocky sides rising almost perpendicular from the water's edge. The pace increased and Eugene at the helm skilfully evaded the rocks which here and there threw up little fountains of spray. But for him the submerged rocks had no terrors as the boat only drew a few inches. On approaching Passau the stream became less turbulent. Emerging from under the Maximilian Bridge we saw our first steamer ; for from this point the river was navigable up stream as well as down.

We had now come some 250 miles from Ulm without meeting or overtaking a single boat or raft, the only craft we had seen had been small boats for local use or ferries.

The complete cessation of trade on the upper reaches of the Danube, which old Mollfender had deplored, was indeed a fact.

The official in charge of the wharf belonging to the Danube Steam Navigation Company ("Donaudampfschiffahrtsgesellschaft"!) who gave us permission to tie up our boat, was somewhat mystified by our arrival.

"Whence have you come? Where are you going?" he asked.

"Ulm-Vienna," we replied.

"The *Herren* would have travelled quicker had they come by train from Ulm to Passau," he observed.

We did not argue with him but followed Eugene to the Bayrischer Hof. In the evening we crossed the Danube by the chain bridge and ascended to the Belvedere whence we had a marvellous view of Passau, the valleys of the Ilz, Danube and Inn, and their junction, the Bavarian Forest, and in the distance Berchtesgaden and the Salzburg Alps.

Leaving Passau next morning we had a beautiful but brief view of the town, standing like an island between the waters of the Inn and the Danube, before our boat was swept round a corner between high cliffs.

A few miles lower down the river after passing the Jochenstein, a rock in midstream bearing the Austrian and Bavarian arms, Eugene told us that in order to avoid a troublesome customs examination at Engelhartszell it was wise to purchase *Leber-kase* from the Austrian douanièr.

On coming alongside the little jetty we found a solitary douanièr and we immediately demanded some liver cheese. He called out for his wife, Lisl, who produced a noisome piece of the local delicacy the size of a brick for which we paid two kroners.

As a result of this transaction Lisl's husband never even came on board our boat and a few minutes later we continued our journey on the Austrian Danube.

Eugene ate half the chese with gusto and the remainder we used as bait with indifferent success.

During the rest of the day the current carried us swiftly through almost mountainous scenery and past many ruined castles.

At Linz we landed above the bridge and slept at the Rother Krebs where we ate large quantities of the famous *Linzer-Torte*.

It was a late start next morning as we had much to see at Linz. At Enns, whose walls were built by Leopold of Austria, out of the ransom paid for Richard Cœur de Lion, we bought excellent peaches and nectarines.

That night we stayed at the Hernal in Grein. We sat late in the *Weinstube* listening to the village worthies who told us harrowing stories of the *Strudel* or whirlpool before it was made safe for navigation by blasting the rocks in 1866. One old man told us that there had been instances of people disappearing in the whirlpool, their bodies appearing a week later in the Plattensee in Hungary! At the mention of '66 a one-armed man interrupted the conversation:—

"Aye, that was the year of Sadowa when I lost my arm; it was that accursed Prussian needle-gun which beat us!"

The passage of the *Strudel* next morning was disappointing. We experienced no thrills, and the current seemed little faster than that above Passau.

At Melk we went ashore and visited the Monastery. Edward was rather intrigued by the headwear of the monks who wore bowlers! From a window of the Monastery we looked across the Danube and tried to reconstruct Marbot's feat.[1] But it was difficult to see how, owing to the conformation of the hills, the Danube could ever have been a league (2½ miles) across however much it was in spate!

"You must buy wine in Melk," said Eugene as he met us outside the Monastery, "for you are now in the famous wine-growing district of Die Wachau."

The *Wein-handler* to whom Eugene took us produced red and white wine at 50 kreutzers a bottle.

"Which shall it be, red or white?" said Edward turning to Eugene.

"The red is the best, but if you drink too much it goes to your feet," he replied.

We bought several bottles of the red as I thought it wise to lay in a good stock.

Edward said that it did not matter if the wine went to our feet while we were sitting in the boat as long as it did not go to our heads. I translated this to Eugene who appeared to consider it a sound argument.

Leaving Melk, sweltering under the midday sun, we floated gently on and ate an excellent lunch washed down by a bottle of wine each. . . .

It must have been nearly two hours later on that hot afternoon when the crash woke us. Eugene was the first to come to, indeed he pretended afterwards that he had never been asleep.

Looking up from the bottom of the boat, I saw a tall man, stripped to the waist and very hairy, towering over our bows and apparently arguing

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[1] "Mémoires du Général Baron de Marbot," tome ii, chapitre xiv.

with Eugene. Sitting up, I realized that the tall man was standing on a raft, on to which we appeared to have "run aground."

"What does he want?" I asked Eugene.

"He demands a bottle of wine, which he says is the custom when one boat runs into another. I told him to go to the devil," Eugene continued, "also that with three men steering his bundles of logs he ought to be able to avoid a respectable boat where the Danube is a mile broad!"

"Who are you?" I asked the hairy man, who had adopted a somewhat uncompromising attitude.

"Franz Niederbichler, raft and crew, Linz to Pesth," he replied.

"We admit that it was our fault," said Edward, joining in the conversation, "and here are two bottles of wine!"

With a "*Habe die Ehre*" the big man accepted the peace-offering and invited us on board.

It was a large oblong raft. Behind were three helmsmen steering with three lashed oars—in the bows was a small wooden hut with a chimney, and in the centre a pile of casks and sacks.

These raftsmen spent their lives on the Danube, and very interesting it was listening to their reminiscences, as they smoked our Navy Cut tobacco in their china pipes. Franz Niederbichler kept on examining our boat with evident interest. At last he said to Eugene:—

"Where did their excellencies buy this boat, and what did they give for it?"

Unblushingly Eugene replied: "They bought it in Ulm for 60 marks, and they will take 60 kroners for it in Vienna."

Edward motioned Eugene to the other side of the raft.

"You get ten per cent," he whispered.

Franz Niederbichler examined our boat again.

"I will give you 20 kroners!"

Eugene put on an injured expression and said that the *Herren* might as well give their boat away. But after further haggling Eugene agreed to 25 kroners with the oars thrown in. It was decided that Franz would leave his raft at Nussdorf outside Vienna, pick up our boat at the Brigittenau bridge on the Danube canal, and rejoin his raft in the main river below Vienna.

By this time as we were approaching Dürrenstein, we began to take leave of the raftsmen.

"Why land at Dürrenstein?" asked Franz.

"Because we want to see the dungeon where Richard of England was imprisoned by Leopold of Austria," answered Edward.

"That is a myth which no sensible man would waste time on," observed Franz, "but in any case you can't sleep at Dürrenstein; you must stay at Stein or Krems," he added.

"Which has the best inn?" I asked.

"There is little to choose between the Elephant at Stein and the Hirsch at Krems," was the reply

"The Elephant every time!" exclaimed Edward, adding some irrelevant remark about the "Castle."

"That the Herren will find close to the bridge," observed Franz, gravely.

Like good tourists, Edward and I photographed one another standing in the entrance to Richard's cell in the castle of Dürrenstein. Edward even walked up and down outside the cell window as Blondel, playing an imaginary harp. Eugene, completely mystified, shook his head and muttered something about the potency of the wine of Die Wachau.

After leaving the Elephant at Stein next morning we found ourselves amongst a veritable archipelago of islands. Without our Eugene we might often have taken a wrong turning. The current slowed down, and for considerable stretches we had to take turns with the oar until after midday, when the channel narrowed as we approached the Wiener Wald.

Late in the afternoon we entered the Danube Canal, and handed our boat over to Franz Niederbichler who was awaiting us at the Brigittenau Bridge.

Eugene was very gratified when we handed Franz's 25 kroners to him together with his last day's wages, third class fare to Ulm, and our cooking utensils. When we shook hands with him we little thought that we should meet him again six years later.

Hailing a *fiaker* we drove to the Hotel Imperial, and after a week in Vienna, we continued our journey by steamer to the Black Sea.

Current Literature.

DEPT. SCIENT. AND INDUST. RES. **Report of the Water Pollution Research Board for the Year ended June 30, 1933** [ROBERTSON R., Chairman], **with Report of the Director of Water Pollution Research** [CALVERT, H. T.]. 50 pp. 1934. London: H.M.S.O. [1s.].

The Board reports a continuation of the investigations which were in being last year. The purification of beet sugar effluents has been further investigated from the bacteriological side, and from the chemical aspect. It has been found that the addition of between 0·3 and 3·0 parts of P_2O_5 per 100,000 under certain conditions results in the ready oxidation of sucrose by biological filters, active films being deposited and a percentage purification of 98 per cent being achieved. Experiments on the purification of milk factory effluents have been begun at Rothamsted. The biological oxidation of cellulose is being examined and it has been found that the activated sludge process is of little value for this purpose but percolating filters oxidize about 70 per cent. The comprehensive scientific survey of the

River Tees has been completed. Further progress has been made in the investigation of the base-exchange method of water softening and on the various factors affecting the action of water on lead. The summary of the existing knowledge relating to plumbo-solvency, reference to which was made in the last report, has been revised and enlarged and is to be published as Water Pollution Research Technical Paper No. 4. Investigation of the activated sludge process of sewage treatment has been continued at the London School of Hygiene. It has been found that domestic sewage sterilized in various ways has no significant biochemical oxygen demand but that initiation of oxygen absorption is immediate following on the inoculation of the sterile sewage with small seedings of crude untreated sewage or of pure strains of certain bacteria. It has been shown that bacteria or bacterial enzymes are essential if oxidation of domestic sewage by dissolved oxygen is to occur. Further experiments indicate that under certain conditions enzymic activity alone, that is to say in the absence of living bacterial cells, can promote the biological oxidation of sewage. A much improved methylene blue test for the sterility of sewage has been elaborated. At University College, London, the investigation of the colloids of sewages has been continued and a study of the electrical properties of sewage colloids has been begun.

M. E. DELAFIELD.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 5.

PFLÜKER, W. AND GAUTSCH, H. **Chlorination and Dechlorination of Water Supplies.** *Angew. Chem.* 1933, v. 46, 482. [Summary taken from *Dept. Scient. & Indust. Res. Water Pollution Research. Summary of Current Literature.* 1934, v. 7, 45-6.]

Report of paper presented before the Verein Deutscher Lebensmittelchemiker, May, 1933. The requisite rate of chlorination of a water supply varies with the composition and temperature of the water and can be determined better from the chlorine number than from the permanganate demand as permanganate oxidizes chiefly humic and few albuminous substances whereas chlorine first attacks albuminous substances. Tests at the Solingen chlorination plant showed that using 0·1 mg. per litre excess chlorine, free chlorine was first detected after the plant had been in operation for twelve hours. Experiments on the bactericidal effects of gaseous chlorine, chloramine and hypochlorite on *B. coli* indicated that with 0·05 mg. per litre excess chlorine, chlorine gas was most effective, with 0·1 mg. excess chlorine chloramine was as effective as chlorine gas but hypochlorite was less effective; while with 0·2 mg. per litre excess chlorine hypochlorite was as effective as chlorine gas or chloramine. Investigations on dechlorination with peat showed that the excess chlorine was converted to hydrochloric acid, the action being catalysed by manganese present in the peat. Peat filtration did not affect the taste of the water. By suitable

treatment of the peat the yellow colour of the first portion of water can be reduced to a minimum. Peat is cheaper and more reactive than active carbon but its action on chlorphenol tastes varies; some peats completely remove chlorphenols but others do not. (*Z. Untersuch. Lebensmitt.* 1933, July/August, v. 66, 62.)

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 5.

BUTTERFIELD, C. T. **Observations on Changes in Numbers of Bacteria in Polluted Water.** *Sewage Works J.* 1932, v. 5, 600-622. [Summary taken from *Pub. Health Engineering Abstr.* Wash. 1934. January 27, v. 14. Signed C. G. GILLESPIE.]

These studies compare the results of bacterial examinations on unstored Ohio River water between Cincinnati and Louisville, with those on samples stored at 10°, 20°, 37° C. for four hours to forty days. At all three temperatures the 20° gelatine count and 37° agar count underwent a considerable and rapid increase usually reaching a maximum at twelve hours for 37° C., at twenty-two hours for 20° C., and at fifty hours for 10° C., after which there was a rapid decline, being greatest for the highest temperature of storage. The coli aerogenes index underwent little change up to four to forty-eight hours, depending on the station, but these bacteria tended to increase, reaching a maximum in four to forty-eight hours, the time required apparently not dependent on the temperature of storage. The maximum reached shows an erratic relationship to the initial, ranging from practically no change to as much as thirty-five times. The changes apparently were not explainable by the nature of the containing vessel, size, exposure to light, air space over the water or agitation. The changes from natural conditions appear to be the result of a change in the environment.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 5.

WATABIKI, T. AND HIMENO, S. **A New Method for the Determination of *B. coli* in Water.** *Keijo J. of Med.* 1933, v. 4, 73; *Wass. u. Abwass.* 1933, v. 31, 251. [Summary taken from *Dept. Scient. & Indust. Res. Water Pollution Research. Summary of Current Literature.* 1934, v. 7, 57.]

A new process for determining the degree of pollution of a water involves the use of neutral red lactose bouillon which is made by adding 5 grammes of Liebig's meat extract, 5 grammes of peptone and 2·5 grammes of lactose to 100 cubic centimetres of water, treating the solution with soda to give a pH of 7·2-7·4 and with 10 cubic centimetres of 0·1 per cent neutral red alcohol and autoclaving. One cubic centimetre of the bouillon and 4 cubic centimetres of the water to be examined are incubated for twenty-four to forty-eight hours at 37° C. in a fermentation tube; three tubes are used for each test. If the solution is unchanged or becomes turbid and gas formation does not exceed 0·5 cubic centimetre in forty-eight hours, the water

is unpolluted. With polluted water the solution remains red, becomes turbid, and forms more than 0·5 cubic centimetre of gas in forty-eight hours. The water is slightly polluted if more than 0·5 cubic centimetre of gas forms in one tube, or even in all three tubes if no fluorescence appears after twenty-four hours. With strongly polluted water more than 0·5 cubic centimetre of gas forms in all three tubes, in each of which fluorescence occurs after twenty-four hours. A diagram of the fermentation tube used is given.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 5.

MALCOLM, J. F. **The Occurrence of Coliform Bacteria in Milk.** *J. Dairy. Res.* 1933, v. 5, 15-28, 1 fig. [23 refs.]

The author gives particulars of the coliform content of 21,569 samples of mixed cows' milk. They were taken within twenty-four hours and many within twelve hours of milking. Their proportional prevalence was much higher in summer and early autumn than during winter and spring. This seasonal difference was largely due to atmospheric temperature and consequent greater rate of increase. [The figures throw no light upon the relative prevalence in samples as collected at milking time at various seasons of the year.] Strains isolated during both summer and winter periods were 797 and a long series of differentiation tests was carried out. The report contains a number of interesting points as to the value and correlation of some tests. For example saccharose and raffinose findings are practically identical, and there was a close positive association between the Koser citrate and the Voges-Proskauer reactions. Of the types isolated 54·2 per cent were *Bact. coli* types, 15·7 *Bact. lactis aerogenes* types, 9·3 *Bact. cloacæ* types and 10·9 per cent intermediate types. Of the strains isolated from milk during the colder part of the year (with the cows in the byres), 71·0 per cent were *Bact. coli* types, 7·5 *Bact. lactis aerogenes* types, 8·6 *Bact. cloacæ* types, and 7·8 per cent intermediate types. The percentages of these four types in the warmer months were 40·4, 22·4, 9·8 and 13·5 respectively. This interesting point as to the higher proportion of *Bact. coli* strains in the byre-confined cows is discussed and various contributory factors considered. The greater liability to fæcal contamination in the cowsheds is probably the most important contributory factor.

W. G. SAVAGE.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 5.

SCHMIDT, H. Zur Ernährungsphysiologie der Diphtheriebazillen. **[The Biochemistry of Media for the Diphtheria Bacillus.]** *Cent. f. Bakt.* I. Abt. Orig. 1933, v. 130, 391-418. [57 refs.]

The growth of five strains of toxigenic diphtheria bacilli was examined on synthetic culture media. All the strains were able to use as source of

carbon the salts of acetic, lactic and succinic acids, glycerol and glucose. The individual strains showed no significant difference in their power of utilizing these materials. For all five strains sodium aspartate proved to be the most useful source of nitrogen. Asparagin and glutamic acid were also able to serve as sources of nitrogen, but growth on these substances was not so good as on salts of aspartic acid. The following substances could not be used as a source of nitrogen—glycine, sarcosine, alanine, serine, valine, leucine, proline, phenylalanine, tyrosine, tryptophane, histidine, arginine and glycylglycine. Cystine has no significance as a source of carbon or nitrogen, its value to the bacillus depends upon its S-S group. The usual range of pH within which the bacillus can grow lies between pH 6·2 and pH 8·9. Certain strains can, however, grow over a more extended range (5·9 to 9·4). For the asparagin-cystine-acetate medium the optimum pH for growth is between 7·8 and 8·5. The virulence of diphtheria bacilli may not be affected by long growth and passage in synthetic media but certain strains diminish in virulence after many passages.

C. C. OKELL.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 5.

ROBINSON, D. T. AND MARSHALL, F. N. **Investigations on the *Gravis*, *Mitis* and Intermediate Types of *C. diphtheriæ* and their Clinical Significance.** *J. Path. and Bact.* 1934, v. 38, 73-89. [15 refs.]

This investigation deals with 542 consecutive cases of diphtheria and carriers admitted to the Monsall Fever Hospital, Manchester. The strains of bacilli which were isolated were studied as to the distribution of *gravis*, *mitis* and intermediate types. With the exception of 1·5 per cent of atypical strains, the strains from the Manchester area were classified with little difficulty by the criteria laid down by ANDERSON, HAPPOLD, McLEOD and THOMPSON [this *Bulletin*, 1932, v. 7, 59]. The contention of the Leeds workers was confirmed that the *gravis* type is a much more potent cause of severe and fatal infections than the *mitis* type [this *Bulletin*, 1933, v. 8, 294]. Thus of 129 *gravis* infections 31 per cent were severe and 29·5 per cent moderately severe, while of 104 *mitis* infections 3·8 per cent were severe and 21·2 per cent moderately severe. In Manchester the "intermediate" type is at least equal to the *gravis* type as regards severity of infection. Of 296 "intermediate" infections 25·7 per cent were severe and 29·7 per cent moderately severe. The death-rate from *gravis* infections was 13·8 per cent, from "intermediate" 15·7 per cent, and from *mitis* 2·6 per cent. *Mitis* infections were rarely fatal except in complicated cases and were rapidly controlled with serum. Many *gravis* and "intermediate" cases were resistant to serum even in large doses. Twelve cases of diphtheria in Schick-negative persons were met with, eight being of the *gravis* type, four of the "intermediate" type, while no *mitis* infections occurred in Schick-negative persons. Virulence tests in animals indicated

that the *gravis* and "intermediate" strains possess greater virulence than the *mitis* strains as judged by their power to invade the tissues and persist therein.

[This is one of the most thorough studies of the relationship of colonial type to clinical virulence which has yet appeared and it gives a large measure of support to the contentions of the Leeds workers.]

C. C. OKELL.

Reprinted from "Bulletin of Hygiene, Vol. 9, *No.* 5.

GLOVER, R. E. **A Note on the Preservation of Complement.** *Univ. of Cambridge. Inst. of Animal Path. Rep. of Director.* 1932-33, 3rd Rep., 52-7.

The relatively rapid loss of complementary power that occurs in guinea-pig serum, even when stored at low temperatures (0·5° C.) necessitates the use of fresh serum for hæmolytic tests unless some special method of preservation is employed. One of the difficulties of preservation is the maintenance of sterility. Ronchèse has suggested the addition of chinosol for this purpose, and numerous workers have noted that the addition of sodium chloride renders the complement more stable. The author has tested the efficacy of chinosol in combination with various strengths of sodium chloride, the bactericide and the salt being dissolved directly in the serum. He finds that 17 per cent sodium chloride and 0·25 chinosol give the optimal results and, at cold-room temperature, preserve the activity of the complement almost at its original level for twenty days or more. As the author notes, however, this amount of salt gives a hypertonic solution when the complementary serum is diluted ten times [and many workers will probably prefer to use 8·5 per cent sodium chloride, giving an approximately isotonic solution when diluted, even though the time during which activity is maintained is thereby slightly shortened. The author's tables show that with this amount of salt the minimal hæmolytic dose was increased from 0·015 cubic centimetre to 0·02 cubic centimetre in fifteen days, and to 0·03 cubic centimetre in thirty days].

W. W. C. TOPLEY.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 5.

Reviews.

MODERN INHALATION THERAPY. By C. H. Auty, M.R.C.S., L.R.C.P. London: William Heinemann (Medical Books, Ltd.). 1933. Pp. vii + 66. Price 3s. 6d. net.

The author attempts in a small book of 66 pages to advance the cause of inhalation therapy and to widen considerably its scope.

With the application of these methods to certain diseases of the respiratory system we have no quarrel, but it is difficult to see how the syndrome of coronary thrombosis (described on page 42 as heart failure) could be benefited by inhalation, for it may surprise the author to learn that even amyl nitrite gives no relief in this form of anginal pain, and indeed is contra-indicated.

The author also treats such diverse conditions as mitral disease, measles, prostatic enlargement, pyorrhœa, rheumatism, varicose veins, etc., etc., all by inhalations of various sorts.

It may be, as Dr. Auty suggests, that he is in advance of his times; it may be that we are behind them; still another possibility is that history but repeats itself.

Where truth lies the reader must decide for himself, but before doing so may we recommend a study of a book entitled "Round About Harley Street," within the pages of which he may find both amusement and food for thought.

J. H.-S.

MAYOU'S DISEASES OF THE EYE. Fourth Edition. Revised by Fredk. Ridley, B.Sc., M.B., B.S., F.R.C.S., and Arnold Sorsby, M.D., F.R.C.S. Oxford University Press. London: Humphrey Milford. 1933. Pp. xvi + 249. Price 6s. net.

This is a compact volume of 249 pages with 38 illustrations. It is of a size which will readily slip into a coat pocket.

It covers the whole field of ophthalmology and is extraordinarily comprehensive for its size, but, as might be expected, it goes into little detail with regard to actual methods of procedure in examination and treatment.

The book would form an excellent basis for anyone beginning the study of eye diseases on which he might build later and fill in detail. It would also be useful to those more experienced as a sound, rapid review of eye work. It can be thoroughly recommended.

STUDENTS GUIDE TO FUNDUS APPEARANCES. By Fredk. Ridley, B.Sc. M.B., B.S., F.R.C.S., and Arnold Sorsby, M.D., F.R.C.S. Oxford University Press. London: Humphrey Milford. 1933. Pp. 16. 12 Plates. Price 2s. 6d. net.

This is a small volume of 16 pages of letterpress and 12 coloured plates of typical fundus appearances. It has been brought out separately as a

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supplement to Mayou's "Diseases of the Eye," and, used with this book, it should be of value to students of eye diseases. It will help every medical officer who, although not interested in eye diseases as such, uses the ophthalmoscope in the routine examination of his cases.

J. B.

A Short History of Ophthalmology. By Arnold Sorsby, M.D., F.R.C.S. London: John Bale, Sons and Danielsson, Ltd. 1933. Pp. viii + 103. Price 3s. 6d.

In this volume of a hundred pages the author traces briefly the history of ophthalmology from ancient to modern times, from the days of fancies and superstitions to those of microscopy of the living eye.

The book is short, inexpensive, and very readable, and should be of nterest to any ophthalmologist. He may regret the passing of the days when a successful operation would bring him ten shekels of silver, but he will rejoice that no longer as the result of an unsuccessful operation need he suffer the amputation of his hands.

J. B.

A Textbook of the Practice of Medicine. By Various Authors. Edited by Frederick W. Price, M.D., F.R.C.S.Edin. London: Humphrey Milford. Oxford University Press. 1933. Pp. xlvi + 1995. Price 36s. net.

The fourth edition of this treatise on medicine follows closely the lines of former volumes, the last of which appeared in 1929. Four years is a long time in modern medicine, and much of the contents of the work has had to be revised or rewritten.

As a simple yet searching test of the value of this book one may take one of the sections, such as that dealing with syphilis, read it once through, and then record the impressions received. The mental picture conveyed is a clear-cut conception of this disease from which nothing of importance is absent, and yet an harmonious whole is not clouded by multiplicity of detail. It is unnecessary to say more in praise of such an article, which indeed is but representative of the general high standard of writing and clarity of presentation throughout the whole work.

The author is indeed fortunate in having the services of Collier and Adie to deal with the section on neurology—there is nothing else nearly so good in the English language at the present time.

We fully appreciate the difficulty of getting such a huge field of knowledge adequately covered within a space of two thousand pages and are glad that the size and clarity of the type have not been sacrificed to this end.

The tropical section has been written by two of the leading authorities, and though necessarily brief descriptions are given, the reader abroad may rest assured that worn out speculations (so common to many general medicine books which trespass on the tropical field) find no place in this one.

Nor will he find species of the Arthopoda referred to by any but their proper scientific names—for this latter fact he will indeed be grateful.

To Dr. Price's own contributions we need not refer in any detail, but the addition of illustrative orthodiagrams to his already very complete account of cardiac affections is welcome, and is a feature we hope he will develop in future editions.

The work is well indexed, and this important section is singularly free from that annoying phrase "see something else."

When this book first appeared, it encountered some criticism in that it was said to be difficult to read; we do not find this to be the case now, and indeed a work which covers the whole field of general and tropical medicine cannot be expected to read like a detective story.

The truth is that "Price's Medicine" entered the field not so very long ago with many competitors already there. The fact that its fourth edition sees it already occupying the place of the standard English textbook on medicine is one of which its editor may justly be proud. It is because it so definitely fills this position that we unhesitatingly recommend it to all Service medical officers, as a sure bank upon which they may confidently draw for medical knowledge.

J. H.-S.

SURGERY OF THE SYMPATHETIC NERVOUS SYSTEM. By George E. Gask, C.M.G., D.S.O., F.R.C.S.Eng., and J. Paterson Ross, M.S.Lond., F.R.C.S.Eng. London: Baillière, Tindall and Cox, 1934. Pp. xii + 163. 29 figs., 13 plates. Price 16s.

The surgery of the sympathetic nervous system has gone through several phases since the first operations were performed by Alexander, of Liverpool, in 1889, and Jaboulay, of Lyons, in 1899, introduced periarterial sympathectomy for perforating ulcer of the foot.

The periarterial operation had a short-lived if wide popularity, as the results, based on a wrong conception of the sympathetic distribution, failed to procure permanent relief from symptoms. The more complete operation of ramisectomy and ganglionectomy has now taken its place, and in this book the authors endeavour to show the stage that has been reached in the usefulness of these operations. They must be heartily congratulated on the masterly way the subject has been presented.

The very complex anatomy and physiology of the sympathetic nervous system is clearly given in the first chapter and will save the surgeon much laborious search through many books. The authors are careful to point out that the subject is not yet exhausted and further experiment and clinical experience are necessary before final conclusions can be reached.

The careful investigations which the authors have practised in order to determine the types of cases likely to benefit from operation are fully detailed and well illustrated with charts.

In dealing with sympathetic denervation of the upper extremity the authors have given up the method of posterior approach to the inferior cervical and upper thoracic ganglion and adopt a method of anterior approach. In this method the phrenic nerve is exposed from the front and displaced, the scalenus anticus being then cut across close to its insertion. After ligature of the thyroid axis branch of the subclavian this vessel can be retracted downwards and also the pleura, so as to expose the first three ribs and the vertebral bodies. The inferior cervical ganglion can now be seen lying on the neck of the first rib and can be traced to below the second thoracic ganglion.

The results in the authors' hands of this operation for circulatory disturbances of the upper limbs are illustrated by cases, and no extravagant claims are made, but the subject is frankly discussed and the reader is given a good idea of what benefit the patient is likely to derive.

Chapter III is devoted to sympathectomy for disorders of the visceral motor mechanism and provides most interesting reading. The technique of sympathectomy for cases of megacolon is described and a cautious attitude is adopted regarding the final result of such operations, although details are given of cases where great immediate benefit followed the operation.

The effects on the sympathetic nervous system as it affects micturition is also discussed.

Chapter IV dealing with sympathectomy for pain, both visceral and cardiac, is of great interest, and military surgeons will be specially interested with its application to causalgia. This condition followed a large number of war wounds, and amputation and re-amputation was often resorted to without permanent benefit to the patient. The possibility of some relief to these sufferers from the operation of sympathectomy is a marked advance.

The personal work on which this book is based does just credit to the authors and the surgical unit of St. Bartholomew's Hospital.

Every surgeon and consulting library should be in possession of a copy of the work, which is excellently printed in clear type and adequately illustrated.

J. W. W.

Notices.

FIRST INTERNATIONAL CONGRESS OF ELECTRO-RADIO-BIOLOGY.

THE International Society of Radio-Biology announces that His Excellency Benito Mussolini, following the favourable advice of the National Council of Research, approved the calling of an International Congress of Electro-Radio-Biology. This First International Congress of Electro-Radio-Biology will take place from September 10 to 15, 1934, in the Doges Palace at Venice.

The Congress will be presided over by his Excellency, the Marquis Guglielmo Marconi, President of the Royal Academy of Italy, President of the National Council of Research, State Senator, and by His Excellency, Count Giuseppe Volpi di Misurata, State Minister, State Senator.

The object of the Congress is to invite Physicists, Chemists, Biologists, Naturalists, and Physicians, for a discussion on the biological action of all radiations, in order to co-ordinate the respective investigations.

Moreover, the organizers of the congress hope to determine the radio-biological tendency of many present physical and biological investigations.

The Congress also intends to study the chemical and biological phenomena of radiations.

The applications of the radiations to medicine and therapy will not be examined and discussed in this Congress.

For further information application should be made to the General Secretary of the Congress, Dr. Giocondo Protti, S. Gregorio 173, Venice (Italy).

HENRY LESTER INSTITUTE OF RESEARCH, SHANGHAI.

INFORMATION has recently been received regarding the establishment of this new agency for the fight against disease in the Far East.

Mr. Henry Lester, who died in 1926, left funds for the provision of an institute for the study of medical science and, under the advice of a representative of the University of Hong Kong, the trustees decided that the Institute should take the form of a post-graduate organization mainly devoted to research. With this end in view a site, measuring some 350 feet by 500 feet, was purchased in Avenue Road, Shanghai, and on this site fine modern buildings have been erected.

The main building is E shaped and has a frontage of 200 feet, with two wings each ninety feet long and a small central block. There are three main floors with a basement under the main central block and a flat roof over all. The ground floor provides accommodation for lecture halls, library, journal rooms, and administrative offices. The first floor is devoted to physiological sciences and the second floor to pathology, while on the roof provision is made for an aquarium, an insectarium, and some laboratory units.

The laboratory accommodation has been provided on the unit plan, that is to say all rooms either consist of a unit space of twelve feet by eighteen feet, which is considered sufficient for a single research worker, or of multiples of this unit space for groups of workers or special purposes. The partitions between the laboratories are of aerocrete and are non-structural, so that if in the future any redistribution of the available space is found necessary, the rearrangement can be carried out with a minimum of inconvenience and at small cost.

The importance of providing animal quarters designed to give living conditions such as obtain in a modern animal hospital has been recognized and a separate Animal House has been built. This consists of rooms situated round a central court and is equipped with panel heating, cold and hot water, steam, gas, electric light and power and apparently everything else required for the efficient care and handling of the dumb aids to scientific progress.

The equipment of the whole Institute appears to have been carried out on a scale worthy of the buildings and Dr. H. G. Earle, the Director, is to be congratulated on the collection of a staff well qualified to engage in organized research.

The buildings were only taken over at the end of 1932 and so far there has been time for not more than the planning out of the work of the different sections, but with the abundance of material available in China and the facilities provided in this Institute and in the Lester Chinese Hospital for its investigation, fruitful results are to be expected in the future.

AIDED GOVERNMENT MEDICAL OFFICER POSTS IN SOUTHERN RHODESIA.

From time to time the Government of Southern Rhodesia requires medical officers for small out-stations at which it is not desirable to place recently qualified practitioners as there is insufficient work to keep them fully occupied, but which are very suitable stations for active men, retired on pension and fond of country life.

At the present time (June, 1934) there is a vacancy at one station Umvuma, on the railway between Gwelo and Fort Victoria and some thirty

miles from the former town. It is a pleasant village of some one hundred European inhabitants in the midst of a ranching and small mining community.

It is essential that the medical officer be reasonably physically fit and reliable in all respects. There is no hospital at Umvuma but a well-equipped modern hospital is in course of erection at Gwelo.

The actual Government duties of the post are roughly medical attendance on members of the B.S.A. Police and their families, school boarders, indigent persons, prisoners and the medico-legal and public health supervision of the district. In practice this will not be found to extend to more than a few hours work per week.

The Government salary is at the rate of £300 per annum plus certain payments for official mileage and for medicines supplied to patients. Private practice is to be expected but it is hard to compute its value, which may range from £60 to £120 per annum.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

PRELIMINARY RESULTS OF AN INVESTIGATION INTO THE ÆTIOLOGY OF SANDFLY FEVER.

BY MAJOR L. T. POOLE, D.S.O., M.C.,
Royal Army Medical Corps,
AND
BY CAPTAIN ALBERT SACHS,
Royal Army Medical Corps.

[This paper was submitted for publication in December, 1933, and received by the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS on March 5, 1934].

INTRODUCTION.

DURING the past nine years in the Peshawar district, with an average strength of 19,758 troops, the average number of admissions to hospital for sandfly fever has been 1,456 per year. In any one year over this period the number of admissions for both British and Indian troops combined has been 2,218, for British troops alone 1,526, and for Indian troops 989; the smallest number of admissions, on the other hand, has been 767 for all troops, and for British troops alone 285, and for Indian troops 267. In seeking a broad explanation for this wide variation in the incidence it has been found that relatively high figures are always associated with the presence of unsalted troops in the district, and low figures when the troops are salted. In other words, the number of admissions to hospital in any season bears a very close relationship to [the degree of immunity possessed by the troops serving in the district.

The disease accounts for 13·6 per cent of all admissions to hospital, and occupies the second place amongst the more prevalent diseases.

Malaria accounts for the greatest number of admissions, but, whereas many cases of malaria are contracted outside the district, this is not so with sandfly fever.

The disease, which is a non-fatal one of short duration, is endemic in the district, and occurs in epidemic form during the summer months, reaching its maximum usually in June/July, then declining fairly rapidly, with perhaps a slight rise in September, and disappearing in October.

It is known that a very definite degree of immunity is developed amongst those troops which have experienced one season in an endemic area, and that troops fresh to India and unsalted troops in general suffer very heavily during their first year in such an area. If, from the point of view of immunity, troops are divided into three groups, (i) troops fresh to India, (ii) unsalted troops in general, and (iii) salted troops, it is found that the difference in the degree of susceptibility amongst the groups is striking.

(i) *Troops fresh to India.*—During the season 1933 the table given below was prepared and illustrates the degree of susceptibility of troops in their first year of service in this district.

TABLE I.—TABLE SHOWING THE DEGREE OF SUSCEPTIBILITY TO SANDFLY FEVER OF TROOPS FRESH TO THIS ENDEMIC AREA. (BRITISH TROOPS STATIONED IN PESHAWAR DURING SEASON 1933.)

Service in India	Total Admissions during the Months:— April	May	June	July	Aug.	Sept.	Oct.	Total
Under 1 year ..	9	30	30	35	29	12	11	156
,, 2 years ..	5	15	10	15	5	2	1	53
,, 3 ,, ..	6	15	14	17	12	9	8	81
,, 4 ,, ..	3	13	13	12	9	6	5	61
,, 5 ,, ..	3	8	7	9	9	5	3	44
,, 6 ,, ..	1	3	4	2	3	—	—	12
,, 7 ,, ..	—	1	1	4	4	—	1	11
8 and over ..	—	3	4	—	—	—	3	11
	27	88	83	94	71	34	32	429

This table shows how susceptible troops are with less than one year's service. In Landi Kotal, during the same season, forty-eight per cent of the total number of cases occurred amongst British troops with less than one year's service. The figures for Landi Kotal and Peshawar closely correspond.

(ii) *Unsalted Troops.*—A good illustration of the susceptibility of unsalted troops can be given by a study of the conditions in Landi Kotal where the incidence of sandfly fever is high. Normally a British battalion serves one year in this station, and Indian troops two years. The British battalion, which was posted there in 1933, and which came from another district in India, may be considered an unsalted battalion, since out of a strength of 834 only 17 men had had sandfly fever in districts other than Peshawar. The total admissions from this battalion for the year under

consideration were 389, which is approximately 50 per cent of their average strength of 779.

(iii) *Salted Troops.*—On the other hand, in 1933, the Indian troops with a strength of 1,677 were spending their second season in Landi Kotal, and may be considered as salted. Among these Indian troops, which during this season did not consist of Gurkhas, who are highly susceptible, there were only 151 admissions, which was nine per cent of their strength. This low figure amongst the Indian troops must, of course, be assessed, bearing in mind the fact that British troops are more susceptible to sandfly fever than either Gurkha or Indian troops, as shown by McCombie Young, Richmond and Brendish [9].

It is estimated that the total number of "sick days" from sandfly fever in this district approximates to at least 20,000 per year.

The figures which have been given show that sandfly fever is an extremely important disease, and that it accounts for a very considerable wastage of man power. Owing to the fact that the greatest number of cases occurs amongst troops that come from non-sandfly fever areas, the disease is of special importance in a district such as Peshawar, where it may be necessary to concentrate troops drawn from parts of the country outside endemic areas.

Object of the Present Investigation.

The present investigation has been undertaken to show : (i) That the disease known as sandfly fever in the Peshawar district agrees with the clinical description of the disease ; (ii) that it is not associated with the presence in the blood of a leptospira, or any other visible micro-organism.

The transmission of the disease by sandflies, researches into the communicability of the disease by blood inoculations, and the question of a filter passing virus as the cause, form the subject of a separate communication now in the press.

Clinical Observations.

An analysis has been made of the medical case sheets of 2,000 cases that have occurred in the district during 1932 and 1933, and in practically every case the symptoms have conformed to the classical description of the disease. That is, the disease is characterized by sudden onset, rapid rise of temperature to somewhere in the region of 102° to 103° F., slow pulse, flushed face, injected conjunctivæ, frontal headache, pains behind the eyeballs, backache, pains in the muscles, and a general feeling of being "very ill." Temperature falls on the second or third day, after which the patient feels much better, but convalescence is not rapid, the individual being "off duty" for ten to fourteen days. Sometimes the onset is gradual, the man feeling "out of sorts" the day before reporting sick. This is more noticeable amongst the Indian than the British troops. The typical case, however, is one of fever, flushed face, injected conjunctivæ, backache and pains all over the body.

It was found that the duration of pyrexia in 74·1 per cent of the cases lasted from two to three days; that there was a secondary rise in 8 per cent of the cases, lasting about twenty-four to thirty-six hours, after the initial fever of two to three days duration; and that in only 1·5 per cent of the cases was there a continuous fever of six days and over.

The following table gives in greater detail the types of pyrexia together with the duration and the percentages of cases in which they occurred.

TABLE II.—SUMMARY OF THE TEMPERATURE CHARTS IN 2,000 CASES OF SANDFLY FEVER. SEASONS 1932 AND 1933.

Types of fever	Duration	Percentage of cases
Simple	1 day	4·8 per cent
,, ...	2 days	35·6 ,,
,, ...	3 ,,	38·5 ,,
,, ...	4 ,,	9·5 ,,
,, ...	5 ,,	2·1 ,,
Continuous fever	over 6 ,,	1·5 ,,
Recurrence of fever, or cases showing terminal kick		8·0 ,,

Blood Picture.—Total and differential counts were carried out on the third day of the disease in 478 cases. These were done in the clinical side-rooms of three different hospitals and also in the District Laboratory. The third day of the disease was chosen as a likely time when a blood examination might assist in the diagnosis of the disease. In 46 per cent of the cases the total white counts were in the region of 5,000, and in 24·5 per cent in the region of 6,000. The following table gives in detail the total white counts and the percentage of cases which gave these results.

TABLE III.—SUMMARY OF TOTAL WHITE BLOOD COUNTS IN 478 CASES OF SANDFLY FEVER AND PERCENTAGE OF CASES GIVING THE COUNTS. ALL COUNTS TAKEN ON THIRD DAY OF DISEASE.

Total white counts	Percentage of cases
3,000 W.B.C.s per c.mm.	1·5
4,000 ,, ,, ,, ...	16·0
5,000 ,, ,, ,, ...	46·0
6,000 ,, ,, ,, ...	24·5
7,000 ,, ,, ,, ...	10·5
8,000 and over	1·5

The majority of the cases gave a polymorphonuclear leucocyte count in the region of 65 per cent. There were no changes considered as being of real diagnostic value amongst the other cells.

The findings during the investigation in 1932 (carried out by one of us, A.S.) were similar to the above.

LABORATORY WORK.

The laboratory work in this report is mainly concerned with investigation into the culturing of blood for possible micro-organisms, and animal experiments.

During the season 1932 an investigation was carried out (by one of us, A.S.), and in three cases an organism belonging to the spirochætal group

was discovered in culture. This organism was from 6 to 9μ in length and 0·5μ broad. It had six to eight regular fine coils and pointed extremities. The coils appeared to be fixed and rigid, and motility was never observed. It could be stained by Fontana's method. In the stained specimens it resembled *T. pallidum* somewhat, except that the coils were more open and drawn out. It was an extremely delicate organism, and difficult to subculture, but subcultures were successfully obtained and the organism was kept alive for several months. The organism could not, however, be recovered when injected intraperitoneally into guinea-pigs. A somewhat similar organism with well-marked spiral twists, which showed no motility, has been described by McCombie Young, Richmond and Brendish [9]. They obtained it from a sandfly fed six days previously on an infected case.

In consequence of this spirochætal organism having been isolated in 1932, the Medical Directorate at Simla decided to carry out a further investigation during the season 1933, to find out whether or not this spirochætal organism had any bearing on the ætiology of the short fevers that occur in the Peshawar district.

Blood Cultures.—During the season 1933, blood cultures were taken on the first day of the disease in 470 cases.

The technique adopted was that advocated by Taylor and Goyle (1931) [10], for the cultivation of leptospiræ. Fletcher's medium (1928) was the culture medium used for the majority of the cases. Most of it was prepared in the District Laboratory, Peshawar, but a certain amount was received from the Central Research Institute, Kasauli. The medium was issued to the hospitals in sealed glass capsules containing about four to five cubic centimetres. Sinton's method, as used for the cultivation of malaria parasites, was also employed for culturing the blood.

In the wards of the hospitals blood was withdrawn from the patient's vein by means of a syringe, and the glass capsule containing the medium inoculated with 0·5 cubic centimetre of whole blood. Immediately this was done, the glass capsule was sealed in a flame, and despatched to the laboratory where it was incubated at a temperature of 25° to 26° C. The object of using sealed glass capsules was to minimize the possibility of contaminations during the long period of incubation.

Many difficulties were experienced in preventing contaminations in spite of the precautions adopted. One of the chief difficulties was to prevent air-borne contaminations. Peshawar is an extremely dusty place, the whole of the Peshawar Vale being enveloped in a haze of dust for many months of the year. Consequently, the media room in the laboratory throughout the season, even although the work was carried out in a room with tightly fitting windows and door, was far from being free of dust. As a result, it was found necessary to carry out work, such as tubing the medium and subculturing, inside a specially constructed box with glass windows, the air inside being sterilized. When this box was taken

into use the contaminations, especially from moulds, were fewer. In the wards of the hospitals, however, with fans going and general movement, a still atmosphere was more difficult to obtain.

The glass capsules used were purchased locally, and a certain amount of difficulty was experienced by the hospitals in opening and sealing them. The reason being that the glass was very brittle and generally of poor quality, the stems in particular being extremely fragile and inclined to shatter and not fracture in a regular manner. This was found to be a point of considerable importance as particles of shattered glass were liable to drop inside the capsules and contaminate the medium. A certain number of capsules of good quality glass were very kindly given us by the Director of the Central Research Institute, Kasauli, which solved many of the difficulties.

Each capsule was incubated for a period of fifteen days before being opened and examined. Specimens for examination were withdrawn from the capsules by means of fine capillary glass tubes, after which the capsules were sealed and replaced in the incubator for a further period of fifteen days. Approximately 50 per cent. of the capsules were examined a second time after thirty days incubation, and 25 per cent. a third time after forty-five days.

Each specimen was examined with dark-ground illumination, a period of roughly ten minutes being spent over each specimen.

Findings.—In not a single case was a leptospira found, and in 69 per cent of the cases the cultures were sterile. Of those that were contaminated, the organisms were found to be extraneous contaminations. In only one case was a pathogenic organism found; that was from a case of staphylococcal septicæmia. Many artefacts were seen, such as granular and globoid bodies, and also many bodies resembling spirochætes, but these were all very definitely the pseudo-spirochætes of the blood as described by Knowles and Das Gupta [8].

Direct Examination of the Blood.—Examinations of the blood, both in the stained and unstained state, failed to reveal the presence of an organism.

Animal Experiments.—The animals used were rabbits and guinea-pigs. Each animal was observed over a period of fourteen days after each experiment, during which time the temperature was taken night and morning. Inoculations were carried out with :—

(i) Whole blood injected intravenously, intraperitoneally and subcutaneously.

(ii) Cultures from cases of clinical sandfly fever that showed bodies which might possibly have been some phase in the life cycle of a spirochæte, injected as in (i).

(iii) Emulsions of sandflies, both fed and unfed, injected as in (i) and also intradermally. In addition, from one rabbit that had received an intradermal injection, after allowing a period of five days to elapse for possible incubation in the animal, a volunteer human subject was inoculated by scarification of the skin with a drop of the rabbit's blood.

None of the animals developed any definite fever, and none of them showed any signs of disease. No leptospiræ or other organisms were recovered from their blood or tissues. The volunteer human subject suffered no untoward effect, but it should be mentioned that the volunteer was residing in the endemic area and had had sandfly fever twelve years previously.

Examination of Sandflies.—Both fed and unfed sandflies were examined with the dark-ground illumination, and Dr. I. M. Puri, who was carrying out the entomological side of the investigation, kindly dissected out the gut and mouthpieces for the examinations. The results were in all cases negative for leptospiræ and spirochætes. Pseudo-spirochætes of the blood were observed in certain of the fed sandflies.

The Spirochæte isolated in 1932.—A search was made to determine where this spirochæte came from, and the Peshawar tap-water was examined for leptospiræ by Hindle's [5] coprozoic method of cultivation, with negative results. In addition, twenty-two rats were examined in 1932 and sixteen in 1933 with negative results.

SUMMARY AND CONCLUSIONS.

The short fevers in the Peshawar district:—

(i) Conform to the clinical description of sandfly fever.

(ii) The causal agent is not a leptospira or other visible micro-organism.

Acknowledgments.—We desire to express our thanks to Colonel E. C. Hodgson, D.S.O., K.H.P., who initiated this investigation; to Colonel E. W. C. Bradfield, C.I.E., O.B.E., V.H.S., for his stimulating advice; to Lieutenant-Colonel I. M. Macrae, C.I.E., O.B.E., I.M.S., O.C., I.M.H., Peshawar, Lieutenant-Colonel T. H. Scott, D.S.O., M.C., R.A.M.C., O.C., B.M.H., Peshawar, and Lieutenant-Colonel A. C. Munro, I.M.S., O.C., I.M.H., Landi Kotal, for placing the clinical material at our disposal. We are also indebted to Dr. I. M. Puri, M.Sc.Punjab, Ph.D.Cantab., F.E.S., for assisting us with the examination of the sandflies.

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DYSENTERY AMONG TROOPS IN QUETTA.

By Lieutenant-Colonel D. T. M. LARGE,
Royal Army Medical Corps.

I.—Epidemiology.

Quetta is subject every year to an outbreak of dysentery which commences regularly when the weather becomes warm, and finishes equally regularly as soon as the cold weather begins. The winter months from early November to early April are comparatively free from dysentery, and only two or three cases a week are reported among the military population. A similar number of cases probably occur at the same time among the civil population, and these winter cases among troops and civilians act as a sort of store-house of infection, from which material is supplied for the commencement of the annual outbreak of dysentery in the spring. The infection in the winter is almost certainly a case to case infection, for flies are practically non-existent from November to March inclusive, fruit is comparatively scarce, and for most of the period the water supply and the milk supply are above reproach.

Figures from which to study the incidence of dysentery in Quetta are available from the year 1928 onwards. Every year since then the figures have been remarkably constant in showing a rise commencing in April and finishing early in November. In each year except 1930, this dysentery season is characterized by two peaks of increased incidence, one in May or June, and the other usually in August, but occasionally in September. Each year except 1930 shows a well-marked drop of dysentery between the two peaks, usually in July, during which there is a distinct lull in the work of the laboratory on which this report is written (*vide* Tables I, III and IV). The report is based on laboratory figures for the last six years and on the study of some 1,500 dysentery and 700 diarrhœa cases in the last two years. The dysentery is chiefly bacillary in nature, and it is never restricted to any one locality or group of individuals.

Certain features of the climate and situation of Quetta have already been outlined in this Journal by Major R. A. Mansell [1], writing on the subject of "Malaria in Quetta." It is now proposed to consider these and other climatic features to ascertain the extent of their bearing on the seasonal variations of dysentery in Quetta.

Rainfall.

Rain occurs in the form of heavy showers in July, and in lighter but more prolonged showers of rain or snow in the winter months from the end of December until well on in April. The total average rainfall for the year, however, is only 9·75 inches, of which about a quarter usually occurs in July (*vide* Table I). This burst of rainfall in July has a very distinct influence

on the water supply of Quetta, which is observable also but to a lesser extent after the milder but more prolonged rain of the spring months. It results in two periods each year during which the water as supplied in the pipes in Quetta is markedly opalescent or even muddy in appearance, due to surface washings from the catchment area, a barren, treeless, completely uninhabited valley some ten miles from Quetta. The early cloud-water period (February-April) is due partly to the melting of the snow on the hills and partly to the moderate amount of rain that occurs at this time, whereas the July muddiness is definitely due to the heavy downpours of rain during this month. The water at these periods invariably shows lactose fermenting organisms in very small quantities of water (one cubic centimetre or less), but the character of the supply area and the supply pipes is such as to exclude any likelihood of these being due to human contamination. Nevertheless, chlorination is carried out, and the water as supplied in Quetta is rendered free from lactose fermenters in 100 cubic centimetres. The danger in the water at this time lies rather in its solid constituents. A centrifuged sample, for instance, shows a marked deposit of tiny particles of siliceous nature, irregular in shape, with sharp, angular edges, very similar indeed in appearance to a deposit of powdered glass. It will be noted that the periods in which this state of the water occurs precede the months in which the incidence of dysentery is normally at its highest, i.e. May or June, and August or September. It appears probable that these particles of silica in the water exercise an irritant effect, and after a time may finally reduce the bowel resistance sufficiently to allow the invasion of dysentery organisms when these become prevalent.

Other factors must necessarily come into operation before there is any marked increase in the amount of dysentery, so that though the cloudy state of the water during the spring months may commence as early as February it is not until April that we get the outbreak of dysentery.

At the same time it cannot be said that outbreaks of dysentery are invariably preceded by a period of excessive silica in the water, as there is no record of rainfall before the autumn outbreak of 1931, which occurred after a very dry and dusty summer. Nevertheless it seems likely that the presence of excessive silica in the water is one of the predisposing influences to dysentery in Quetta.

Temperature.

Weekly records have been obtained from the R.A.F. Meteorological Office, Quetta, through the kindness of Mr. A. K. Roy, B.A., B.Sc., of the Meteorological Department, and have been charted in the laboratory along with weekly records of dysentery for the last two years. They show that the dysentery season commences about a week after the mean weekly temperature has reached 60° F. and ceases quite suddenly in October or November when the mean weekly temperature again falls below 60° F. The temperature in Quetta regularly rises week by week from about

30° F. in January to 85° F. in July, thereafter falling just as regularly. A mean weekly temperature in Quetta of less than 60° F., therefore, appears to be unsuitable to the viability of the dysentery-causing organisms during their passage from case to case, or at least unsuitable to the transference of viable organisms from individual to individual.

Relative Humidity.

The relative humidity in Quetta, by itself, appears to have little effect on the incidence of dysentery, unless perhaps the increase of moisture in the air when associated with the summer temperature prolongs the viability of cysts and the bacteria of dysentery, and thereby facilitates the spread of the disease.

Table I.—Table showing { Rainfall in Inches per Month, Dusty Days per Month, Total Dysentery Ratio per 1,000 per Month.

Year		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1928	Rainfall ..	1·46	2·24	2·86	0·18	0·23	0·0	0·16	0·01	0·03	0·0	1·18	0·86
	Dusty days ..	—	—	3	3	7	4	10	10	2	—	—	—
	Total dysentery	—	—	—	3·2	2·9	3·8	2·3	3·3	7·1	8·1	4·7	1·0
1929	Rainfall ..	0·79	3·15	0·05	0·26	0·01	0·0	1·92	0·0	0·0	0·0	0·0	2·72
	Dusty days ..	1	—	2	2	12	7	15	9	—	4	1	—
	Total dysentery	1·5	0·8	0·8	0·7	4·2	4·5	3·1	6·8	5·8	5·3	2·3	1·0
1930	Rainfall ..	2·59	0·80	0·49	2·15	0·03	0·53	2·24	0·0	0·0	0·18	0·15	0·20
	Dusty days ..	—	3	4	5	10	4	10	6	1	—	—	—
	Total dysentery	0·5	0·1	0·3	0·4	1·6	5·6	7·8	8·7	6·8	3·8	3·9	2·8
1931	Rainfall ..	2·22	4·95	1·89	1·03	0·46	0·03	0·05	—	—	—	0·04	0·29
	Dusty days ..	—	—	1	4	8	2	7	5	1	—	—	1
	Total dysentery	1·7	0·9	0·2	0·4	2·0	9·7	4·9	6·3	7·3	8·5	2·5	1·5
1932	Rainfall ..	0·41	0·64	1·23	0·29	0·38	—	2·06	0·71	—	—	—	0·42
	Dusty days ..	2	1	3	5	12	2	6	3	6	3	—	—
	Total dysentery	1·4	1·3	1·2	4·5	8·2	5·9	8·9	36·1	19·6	7·5	2·3	2·6
	Flies	—	—	—	—	—	1770	4465	3319	2135	865	403	29
1933	Rainfall ..	1·62	1·54	1·43	1·13	1·01	—	2·5	0·56	—	—	0·07	—
	Dusty days ..	—	—	3	4	3	6	10	3	2	2	1	—
	Total dysentery	0·6	0·9	0·7	1·4	7·2	13·9	9·8	15·9	17·3	9·4	—	—
	Flies	43	30	24	352	2503	2040	1280	2617	1393	192	24	—

Closely associated, however, with the relative humidity is the amount of dust in the atmosphere, and this also merits consideration in a place like Quetta, if for nothing else, because of the popular opinion that almost every disease and especially dysentery, in Quetta, is attributable to its dustiness.

Quetta is subject to sudden and frequent dust storms, the nature of which can only be appreciated by experience. During a dust storm, doors and windows have to be closed, and even then articles of food left exposed become covered with a layer of dust. At first sight it may appear strange that two apparently inimical factors such as dust and increase of moisture in the air can exist together as possible predisposing influences on any disease. They are, however, intimately associated, as has been pointed out by Mr. A. K. Roy [2] in his paper on "Atmospheric Visibility at Quetta," published by the Indian Meteorological Office in 1932. It appears that increase of relative humidity is usually associated in Quetta with an

increase of atmospheric dust, and that on days when visibility is poor owing to atmospheric dust, the mean humidity is appreciably higher than on clear days.

As regards data in connection with the amount of dust in the air, we are fortunate in being able to obtain figures from the R.A.F. Meteorological Station in Quetta. Records are kept there of climatic occurrences with a view to assist flying, and certain of their figures are of medical interest, especially, in the present instance, those in connection with atmospheric dust. The number of dusty days per month is shown in Table I, together with the dysentery ratio per 1,000 for the past six years. (A dusty day is one which had either a dust storm, or a dust raising wind of over thirty miles per hour, or a dust haze so thick that it reduced visibility below 2½ miles. It means, therefore, a very dusty day).

A study of the table shows that marked rises or falls in the dust curve are frequently followed by similar movements in the dysentery figure in the following months, the most striking example of which is the marked drop shown for many years in the amount of dust in June, followed in July by a similar drop in dysentery.

One is tempted to suggest that frequent dust storms and dust raising winds might increase dysentery in the following months either by the irritant effect of frequently ingested dust or possibly by the pathological effect of wind-blown fæcal particles, but the evidence afforded by our dust figures and dysentery figures is not constant enough to enable one to point to it definitely as an instance of cause and effect. Certainly many bad dysentery months are preceded by excessively dusty months, but a considerable number are not. The dysentery season as a whole in Quetta coincides with the period at which Quetta is most dusty, but it is probable that both are concomitants of other climatic factors rather than that dysentery is dependent on dust storms, etc. This will be referred to later. It is noteworthy however that the autumn outbreaks of 1928 and 1931, which were not preceded by rainfall and a possible irritant in the water supply, can be said to have followed on two excessively dusty months.

As regards the possible effect of dust on dysentery it seems to be generally agreed that although dysentery organisms may survive in damp soil for as long as one hundred days [3] they cannot withstand the sterilizing effect of the tropical sun, so that the only possible effect of dust on bacillary dysentery is an indirect one, by its irritant effect on the intestinal mucosa [4]. It is not quite so certain that dust apart from its irritant effect is entirely harmless as regards amœbic dysentery. Examinations of street dust were carried out by Porter [5] in South Africa and, along with ova of many intestinal parasites, cysts of *E. histolytica* were reported present. It is of course conceivable that dust around Indian latrines may be conveyed during high winds into nearby living quarters ; cysts would not be killed by desiccation, and one therefore cannot entirely disregard the possibility of infection being so spread.

The conclusion one comes to, however, as regards the effect of dust on the causation of dysentery in Quetta is that while it must be regarded with suspicion as a possible predisposing influence, one is not justified in giving it the same importance as, for example, flies or acute carriers. Carriers are discussed later under the heading of "Missed Cases as a Source of Infection."

Fruit.—The fruit supply of Quetta is abundant and cheap during the dysentery season, and it is frequently suggested that fruit plays a large part in the widespread infection. If this were the case, the converse should hold, that is, no fruit no dysentery. An opportunity to put this to practical test occurred in the autumn of 1932, when there was a local outbreak of cholera, on account of which the sale of all fruit and ice was stopped in barracks, and troops were prohibited from entering the city. Therefore fruit if eaten at all could have been obtained only secretly and in small quantity. There was no reduction in the dysentery-rate however; quite the reverse in fact, as reference to almost any of the tables accompanying this paper will show. Therefore infected fruit can have only a small contributory influence on the amount of dysentery and the main source of infection must be looked for elsewhere.

Flies.

The relationship between the incidence of flies and the incidence of dysentery has been stressed times without number in districts other than Quetta, and as is to be expected a similar relationship has been found here. Similarly it has been shown that the fly incidence depends to a large extent on the amount of moisture in the air, and Manifold [6] has pointed out the resemblance in Poona between the curves of humidity, flies and dysentery.

In Quetta, however, flies are never as numerous in barracks as in a large number of other Indian stations, and it is difficult to understand the occurrence of large numbers of dysentery cases during a period when flies do not appear to be numerous as judged by experience of other stations. One was led therefore to seek a cause for the dysentery in other factors, predisposing or otherwise, such as dust, water, or missed cases.

Nevertheless there can be no question about the close relationship between flies and dysentery in Quetta, however much or little these other factors come into play.

In June, 1932, a fly count was instituted, and traps and fly papers were set in the precincts of the laboratory. Careful observations were made and careful records were kept, with the result that considerable local information is available as to the incidence of flies in Quetta and their relation to dysentery.

During the two years in question, 1932 and 1933, flies were absent, or certainly unnoticeable, as long as the mean weekly temperature remained below 60° F. As soon as this temperature was exceeded flies appeared in

noticeable numbers in the shade of houses and inside cookhouses, etc., and they remained in noticeable numbers during the hot weather until the mean weekly temperature again fell below 60° F., with the onset of the cold weather. Their numbers, however, were not constant during the hot weather, but varied with the relative humidity. Given a temperature above 60° F. they increased as the humidity increased and diminished when the humidity fell.

TABLE II.—WEEKLY FLIES AND DYSENTERY, 1933.

Week beginning		Flies	Dysentery
April	14	60	2
	21	158	6
	28	297	9
May	6	361	14
	13	355	25
	20	479	17
	27	1584	31
June	3	544	31
	10	315	31
	17	363	42
	24	349	17
July	1	291	12
	8	278	22
	15	129	12
	22	249	19
	29	765	13
August	5	335	8
	12	371	21
	19	822	33
	26	623	35
September	2	302	37
	9	393	29
	16	385	32
	23	138	30
	30	68	24
October	7	33	24
	14	8	15
	21	3	14
	28	—	—
November	5	—	10
	12	—	8
	18	—	6
	25	—	8

The year 1933 has been chosen to illustrate this point in Table III, as the variations are very striking. It will be seen that there is a rough similarity between the figures for humidity and for flies, so that, for instance, a decrease in humidity in June is followed immediately by a decrease in the number of flies, and similarly an increase of humidity after rain in July is shortly succeeded by an increase in the fly incidence.

This reduction in the number of flies in June due to the decrease in humidity has the effect of causing the graph of fly incidence to assume the form of two peaks, separated by an intervening drop. This, however, is exactly the form taken by dysentery incidence, and it will be seen on consulting Table III, that increases or decreases in the number of flies are followed after a short interval by similar variations in the number of dysentery cases—a clear indication that Quetta dysentery is also closely associated with flies.

This, however, is not proof that dysentery in troops is carried to them directly by flies, and in the opinion of the writer the number of troops who contract dysentery directly from flies is not so great as commonly supposed. It must not be forgotten that in peace time medical control is exercised over practically everything the soldier eats. Not only are dining-rooms and cookhouses in barracks fly-proofed, but troops' restaurants and eating-houses outside barracks are under medical control, so that a constant war is waged against the access of flies to the soldier's food.

TABLE III.—FLIES AND DYSENTERY, 1932 AND 1933.—BY FORTNIGHTS.

	Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Nov.		[illegible]	
Fortnight																								
1932—																								
Flies ..	—		—		—		—		--		—	900	1645	2385	2359	1234	1418	717	523	337	183	314	22	[illegible]
Dysentery	5	8	4	7	7	8	14	23	33	43	29	20	35	41	147	130	97	60	32	20	17	17	11	[illegible]
1933—																								
Flies ..	29	14	26	4	17	7	32	320	710	1793	1300	740	769	711	914	1703	860	533	97	5		—	-	
Dysentery	2	2	6	2	9	8	11	10	32	58	67	60	38	32	28	71	76	68	49	30	14	16	-	
1933—																								
Humidity	—		—		—		62	55	56	40	28	39	42	69	66	66	61	33	—			—	-	
Temp. ..	39	37	42	43	51	48	58	63	68	75	76	82	83	82	80	78	70	64	63	58	51	—	-	

Therefore flies are seldom found in quarters used by the troops in anything like the numbers in which they swarm in uncontrolled areas. The infection of food from flies in camp or in an Indian bazaar is understandable from the immense numbers of the flies, but to attribute large numbers of cases amongst, for instance, British troops to the comparatively few flies to be found in their quarters is to imply that flies in barracks are heavily infected with dysentery, which would be a sad reflection on our hygiene in barracks.

Actually the flies caught in the barrack area are not heavily infected with dysentery, as was proved by daily culture of emulsified trapped specimens which revealed only two Flexner organisms during the whole of one dysentery season.

The infection of troops with dysentery through the agency of flies is probably to a large extent brought about indirectly, especially in the case of British troops, through the medium ; (1) of the menials in attendance on them over whom no real medical control is exercised ; and (2) of those troops (probably comparatively few in number) who eat infected food in the bazaar. That is to say, it is a contact infection from individuals who become infected mainly in areas outside control, many of whom do not report their dysentery for various reasons, which will be discussed later.

The tables for 1933 help to bear out this point showing that the period which intervenes between the maximum and minimum points of the fly curve and the maximum and minimum points of the dysentery curve is two to four weeks, which is considerably longer than the maximum incubation period of bacillary dysentery. If the writer's contention is correct, that dysentery in Quetta is to a considerable extent a contact infection, it would supply a reasonable explanation for this rather lengthy interval, for infection derived directly from fly-infected food by one individual, and passed on by him to other individuals by means of soiled hands, etc., requires a period of time equal at least to two incubation periods before its effect is shown in the dysentery curve.

It may well be that fly prevalence initiates the outbreak of dysentery by means of direct infection, but a graph made from the weekly figures for dysentery and flies shows that the majority of dysentery cases in Quetta occur between two and four weeks after flies have diminished.

This is strong evidence in favour of indirect infection (in so far as the dysentery is bacillary). That is, it is a case to case infection, the extent and importance of which is not sufficiently recognized in prophylaxis. Certainly the frank dysenteries are removed to hospital, but the infection spread by them before removal, and also by certain milder unrecognized cases, on feeding utensils, for example, must not be forgotten.

TABLE IV.—DYSENTERY, MAY AND JUNE, 1933.

	Average strength May and June	Cases of dysentery May and June	Rough percentage
Officers and wives	508 ..	21 ..	4
B. O. R.s	2,883 ..	55 ..	2
Indian troops	8.228 ..	85 ..	1
Officers' children	141 ..	31 ..	22
B. O. R.s children	428 ..	17 ..	4
Indian children	1,661 ..	7 ..	0·4

Note.—The higher the social scale, the more evident the dysentery, for the officer's family as a rule pays more attention to health matters than the families of other ranks, and the mildest dysentery is brought to medical attention.

MISSED CASES OF DYSENTERY AS A SOURCE OF INFECTION.

Although the amount of dysentery reported in Quetta has been high in recent years compared with other Indian stations, it is probable that a true estimate of the full amount has not yet been reached. Bacillary dysentery is on the whole a mild infection, and in a considerable number of cases is so mild as to escape unnoticed, or to be regarded as a mere diarrhœa. As such cases, though mild, are potentially infectious, and as the nature of the infection passed on by them is not necessarily mild in every infected individual, it is important to recognize their existence in order that the adoption of hygienic measures to prevent possible infection from missed cases may be considered.

To draw attention to such cases and in support of such statements, no doubt somewhat alarming to those who consider that Quetta has already

sufficiently distinguished itself by its high rate of dysentery, certain inferences drawn from various data collected during 1933 are put forward for consideration. (There can be little doubt but what applies to dysentery in Quetta as regards mild cases is applicable elsewhere in India.)

(1) *Percentage Incidence in Children and Adults.*

Probably the most complete figures that are available for dysentery among any one class of the population are those for officers' children, doubtless owing to the careful watch kept over them, and to the facilities available for the speedy despatch of specimens to the laboratory. The figures for 1933 show that 22 per cent of all the officers' children in Quetta were proved to have suffered from dysentery (see Table IV). When we find that only 4 per cent of the children of other ranks were proved to have the disease, we are bound to look for some explanation of this startling disparity in numbers, and it is suggested that the probable explanation is that a considerable number of cases are overlooked. It is reasonable to assume that these children run as much risk of infection as officers' children, if not actually a greater risk, owing to less attention to details of hygiene and possibly also to greater ignorance on the part of the parents. It is, therefore, very probable that at least as many of the children of other ranks contract dysentery as do officers' children. That many of these cases are not diagnosed as dysentery is probably because they are so mild that medical advice is not obtained, and yet such children are a potential source of infection. From this it will be seen that the existence of missed cases of dysentery among this class of children may reasonably be assumed.

To pass on now to the figures of dysentery among British troops, the remarkable difference between them (2 per cent) and among British officers' children (22 per cent) is at once apparent. No doubt this is largely due to the fact that adults are less liable to intestinal trouble than are children, but the disparity is too great to be entirely accounted for by this fact, and from this it appears probable that there are a considerable number of cases amongst the troops also which are missed because of their mildness.

TABLE V.—DYSENTERY, MAY AND JUNE, 1933.

	Adults (all classes)		Children (all classes)	
	Cases	Per cent	Cases	Per cent
Flexner A1	12	7·4	3	5·3
,, 170	10	6 2	1	1·8
,, 88	17	10	2	3·7
,, P274	1	0·6	—	—
,, Inagg.	11	6·8	—	—
Sonne	34	20	26	48
Schmitz.	1	0 6	—	—
E. histolytica	16	9·9	—	—
Bacillary exudate (No organisms found)	29	18·0	12	22
Indefinite exudate (No organisms found)	31	19·2	9	16
	162		53	

Note.—Sonne dysentery was by far the commonest form both in adults and children. The different types of Flexner will be alluded to later.

The organism responsible for the infection during the period under review was in large part *B. dysenteriæ* Sonne, which in Quetta at any rate produces a very mild infection, an infection less likely to be detected in the case of an adult than in a child owing to its very mildness. It predominated, however, in the case of dysentery in adults during the period just as it did in children. See Table V.

(2) *Diarrhœa Curve.*

Further evidence as to the existence of considerable numbers of missed cases throughout the year is afforded by the diarrhœa figures given in Table VI, which shows the relative incidence of total diarrhœa over a

TABLE VI.

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec
1932	Dysentery ..	13	11	16	38	79	55	78	298	180	57	36	25
	Diarrhœa ..	7	11	10	40	37	29	28	94	65	27	19	6
1933	Dysentery ..	4	8	10	19	91	126	68	91	132	81	30	—
	Diarrhœa ..	6	7	13	10	50	57	50	55	68	44	15	—

period of two years. It will be seen that all large increases or decreases of dysentery are accompanied by similar though smaller increases or decreases of diarrhœa. The figures follow such a similar course that they strongly suggest an identical cause for the two diseases, that is they suggest that considerable numbers of the so-called diarrhœas are in reality missed cases of dysentery. Such cases are missed either because they are recovering by the time they come under medical attention, or because clinical and laboratory examinations did not coincide with the period of excretion of dysentery bacilli, a period which in some of these cases may last only a few hours.

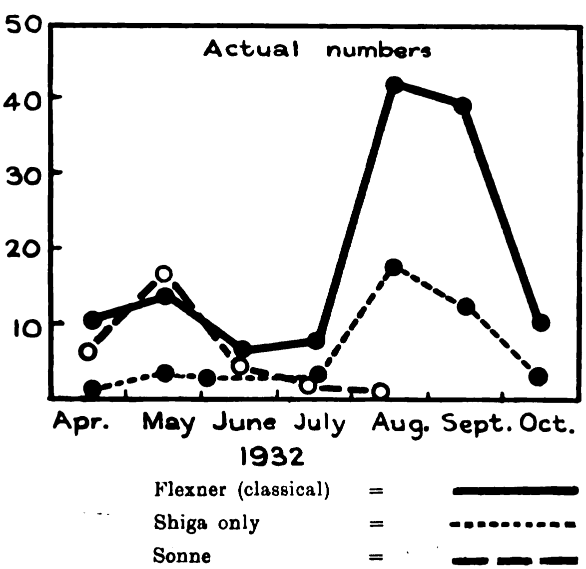

CHART 1.

(3) *The Increase of Dysentery in the Last Two Years.*

It has been the policy in the last two years in Quetta to regard every case of severe diarrhœa as suspicious of dysentery, so that British cases are actually detained in hospital for a few hours until specimens have been examined, and specimens from Indian troops suffering from diarrhœa are sent direct from their medical inspection rooms. The result has been a very marked apparent increase of dysentery as shown in Chart 1 (p. 89). As these methods of dealing with dysentery were not in force before 1932, I think it is more than likely that the increase in the figures is due to the institution of these methods, rather than to a real increase of the disease. That is, dysentery cases were discovered during these two years which under more usual circumstances would have been missed.

(4) *The Incidence in British as compared with Indian Adults.*

If one considers the dysentery ratio per 1,000 before 1932, when the present attempt to avoid missed cases was commenced, one notices that Indian troops do not largely figure in the spring rise of dysentery (see Table VII), whereas in the autumn rise their rate is at its highest and is

TABLE VII.—DYSENTERY RATIO PER 1,000.

	1928		1929		1930		1931	
	British	Indian	British	Indian	British	Indian	British	Indian
January ..	—	—	0·8	0·7	0·4	0·1	1·2	0·5
February ..	—	—	—	0·4	—	0·1	0 4	0·5
March ..	—	—	0·4	0·4	—	0·8	—	0·2
April ..	—	—	—	0·7	—	0·4	0·4	0·8
May ..	0·7	2·2	2·8	1·4	0·7	0 9	1.1	0·9
June ..	1·5	2·3	2·8	1·7	3·3	2·3	5·4	3·3
July ..	0·8	1·5	1·5	1·6	4 1	3·7	3·2	1·7
August ..	0·8	2·5	3·1	3·7	4·1	4·6	2·2	4·1
September ..	1·2	5·9	—	5·8	2·4	4·4	3·7	3·6
October ..	0·8	4·9	2·3	3·0	1·1	2·7	3·7	4·9
November ..	2·0	2 7	0·8	1·5	2·6	1·3	1·2	2·4
December ..	0·4	0·6	—	1·0	1·6	1·2	—	1·5

invariably higher than the British. Now the spring rise of dysentery in Quetta differs from the autumn rise in that it is due in large part to a different organism. It will be shown hereafter that in the spring rise the predominant organism is *B. dysenteriæ* Sonne, whereas in the autumn rise this is completely replaced by Shiga and the classical Flexner organisms. That is, severe dysentery is more likely to be met with in the autumn. Hence the Indian rate is highest then, for the Indian goes sick with dysentery only when inconvenienced by it. He is hardly affected by the mild dysentery of the spring, for dysentery is a familiar disease to him and he is not alarmed at a little blood and mucus, if he notices it at all in his almost normal loose stool. The condition lasts perhaps for a few hours only and he has recovered before he has had time to go sick with it. That this is the case is borne out by the clinical evidence of the dysentery in the spring of 1933 in which *B. dysenteriæ* Sonne, *B. dysenteriæ* Flexner 88 and 170 were frequently found in British as well as Indian cases with only one

or two days' slight illness, and also from the writer's personal experience of Sonne dysentery contracted in the laboratory. In his case there was no tenesmus and no inconvenience whatsoever, merely a call to stool at an unusual hour with some looseness and some slight blood and mucus. The stool showed a definite bacillary exudate and yielded a pure culture of *B. dysenteriæ* Sonne. As a result of treatment with salines loose mucous stools occurred on the second day and again *B. dysenteriæ* Sonne was isolated. Thereafter there was no sign of dysentery whatsoever. The amount of inconvenience caused by the dysentery before treatment with salines was infinitesimal compared with the purging caused by the routine saline treatment. There is little doubt that such a case occurring in the unenlightened soldier would never have come to medical notice and would have been missed as dysentery.

Such missed cases are, however, infectious, and what applies to the mild dysentery of the spring as regards missed dysenteries also applies to mild cases of dysentery in the autumn. It may be, indeed I think it is probable, that a considerable amount of dysentery infection in the spring and autumn rises comes from such missed cases of dysentery, more so than is generally recognized, and to my mind, more so than is possible from flies, fruit, water, etc., against infection from which stringent precautions are already taken in military cantonments.

In other words, dysentery, as has long been recognized, is a disease primarily of communities living in close contact, e.g. in camps and asylums, and it is the close contact with recognized cases before they are removed from the community and with the mild and, therefore, unrecognized cases discussed above that is a source of the spread of dysentery which is apt to be forgotten.

This of course applies particularly to the menials who serve the troops in barracks and to the servants of married families. The Indian servant is just as liable to suffer from mild and unrecognized dysentery as the soldier, and even if he does recognize that he has dysentery, it is to his advantage to conceal it. There would appear to be no practicable means of detecting his dysentery unless perhaps one actually paid him for going to hospital with it and guaranteed his employment when cured. This is not quite so Gilbertian as it sounds, for an expenditure of a few annas a day, properly controlled, might save a succession of admissions of troops to hospital. The idea at least is worth consideration.

In one's own household the servants have been encouraged to report the first sign of dysentery, their treatment and re-employment when cured is guaranteed, and on several occasions a temporary man has been engaged to replace such a casualty. It is only by some such method that one can reasonably be assured that the servant who prepares or handles one's food is not himself suffering at the moment from a mild, but none the less infectious, attack of dysentery.

No mention is made of chronic carriers as a source of infection, for

experience in India in recent years has shown that they must be very rare. It is quite exceptional to isolate the organisms of dysentery from any but fresh cases, even by the most intensive methods, and it is quite usual to isolate them in large numbers from the very mildest fresh attacks if laboratory examination is carried out on the first or second day of disease.

The complete prevention of infection from such cases involves their being rendered harmless on the one or two days on which the organisms are being excreted. This is naturally not easy. I doubt if it is even possible, but an advance towards the further reduction of dysentery might be made if diarrhœa amongst troops were regarded with more suspicion than at present, and if a really satisfactory method of dealing with possible dysentery amongst barrack servants could be devised.

Dysentery bacilli implanted on a cup or plate by an individual suffering from dysentery can easily survive drying for the normal period during which the article is lying idle, as the following experiment shows. Pieces of glass were inoculated with a small loopful of Flexner organisms in distilled water. They were placed under a raised Petri dish cover and allowed to dry. At four-hourly intervals a piece was dropped into broth and incubated. The organism was recovered from the glass after it had been apparently dry for as long as ninety-six hours. The textbook period of survival of drying is twelve days. Such an infection on food utensils could of course easily be removed by boiling water.

(To be continued.)

AN INVESTIGATION INTO THE ERUPTION OF THIRD MOLARS.

By Major G. F. CHARLES,
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In the study of the theory that in the selective advancement of the human race there is a tendency for a reduction in the number of teeth, the third molar was, at one time, singled out as being the tooth which would, of all others, disappear in time.

This theory is, however, rather discarded by Norman Bennett, who writes: "Congenital absence of the maxillary second incisor is the commonest example of absence of a tooth and occurs both unilaterally and bilaterally. The third molar, both in the maxilla and mandible, is sometimes absent, but an accurate history and radiograms are necessary before definitely coming to this conclusion."

There is no doubt, however, that the third molar is distinct from the other teeth. Again quoting from Norman Bennett: "The varieties of the third maxillary molar are so complicated and numerous that a normal tooth is very difficult to find among civilized races.

"The proportion of fully erupted mandibular third molars to those imperfectly erupted could not easily be stated, as a definition of either would only be arbitrary. It is certain that this tooth is, of all the teeth, by far the most imperfectly erupted and that a large number never arrive at a condition of complete eruption."

Compared with the rest of the dentition, it is abnormal in shape, size, period of eruption and method of growth, and the differences appear to be so marked that one is tempted to drop the title of "third molar," which definitely places it in the same category as the other molars, and revert to the more popular but less technical title of "wisdom tooth," thus implying that it is a tooth on its own, with its own particular characteristics.

We see that the same differentiation has been made between the incisors and canines and it is suggested that a similar distinction might be made in this case.

The third molars represent twelve per cent of the normal human dentition and, as such, merit the closest attention. There is extensive evidence about their abnormality and the complications associated with their presence but, as far as can be ascertained, there seem to be no very definite facts as to the exact age at which these teeth usually erupt. Nor do any figures appear to be available to show the proportion of erupted to non-erupted teeth.

Mummery says: "Eruption of the maxillary molar occurs at the 17th

to 20th year and eruption of the mandibular teeth usually slightly precedes that of the maxillary teeth."

Norman Bennett gives the ages of eruption as 17 to 25 years.

Into this uncertainty and ambiguity is it possible to introduce any greater degree of accuracy? Is this third molar of any value or not, comparable with the remainder of the teeth?

In private practice, dental standards—as the Army knows them—are non-existent. The patient, if willing, is given the best treatment the dental surgeon considers necessary to render him as effective as possible, though, in certain cases the financial question does intervene, thus making it necessary to adapt the treatment to the financial ability of the patient.

This is not exactly the case in the Army. Here a definite dental standard is laid down, which is the minimum required for a man of the necessary physical condition, and this standard is largely based on molar occlusion.

It is essential, therefore, in estimating the dental condition of a recruit, that full value should be given, not only to the existing teeth, but for any future eruption of the third molars that might take place.

Only too often, one finds that recruits of a perfect physical standard fall short of the required dental standard. In these cases it has been my practice to give full value for unerupted third molars—but the question arises, what value is one justified in giving?

It was a case of this nature that started this investigation. A recruit of 18, who had been accepted, was found to be below the prescribed dental standard and, in the course of time, he was recommended for the supply of dentures. I did not concur in this recommendation in view of the fact that the third molars were not erupted, and I considered that it would be advisable to wait for further developments.

Major-General H. C. R. Hime, then Deputy Director of Medical Services, Southern Command, took the greatest interest in this case and, before dealing with my recommendation, asked me what grounds I had for assuming that the third molars would erupt, and also at what age they could be expected.

In view of the quotations I have given above, it is not surprising that I had no definite information on the subject but was relying on a general average.

I presumed that the majority did have third molars and that they erupted between the ages of 18 and 20. I also added that, during the time I was Senior Dental Officer at Woolwich, I had examined about 20,000 recruits, and one of the things I had particularly noticed was the fact that a large proportion of the men had well-formed third molars.

It was then suggested that, in view of the very important part the eruption of the third molars appeared to play in the estimation of the dental condition of the recruit, it would be of advantage if I carried out an investigation to see if any definite information could be obtained. A cir-

cular was therefore sent out to all dental officers in the Command enclosing the following pro-forma for completion in respect of all men presenting themselves for treatment.

Index No.	Age	Upper R. 3rd Molar	Lower R. 3rd Molar	Upper L. 3rd Molar	Lower L. 3rd Molar

. In completing columns 3, 4, 5 and 6, the following symbols were used :—

"P" = Molar present and in good position.
"E" = Molar erupting within the next three months.
"I" = Molar present but impacted.
"A" = Molar absent and no sign of eruption.
"M" = Molar missing through extraction.

This investigation was carried out over a period of four months and 3,510 cases were examined. This number is not very large when one considers the size of the population, but the investigation gave officers an extra amount of work and, in view of the fact that dental officers are already kept fully occupied, it was not considered desirable to continue this additional work longer than was necessary.

I should like, at this juncture, to express thanks to all dental officers in the Command for the very careful way in which the figures were compiled.

Although the number of cases is small, the figures given represent a possible total of 14,000 third molars and they also have a great value for the following reasons :—

They were not compiled by one officer, but by fourteen different officers scattered over the Command. The men examined were not taken from one district, but were representative of the whole of the recruiting area for the Army, and include men from town and country districts. They therefore have a more general application than a similar number of cases examined in one district only.

The following is an analysis of these 3,510 examinations :—

Cases with all four third molars erupted	1,633 or 46·3 per cent
Cases with all four third molars unerupted	991 or 28·2 ,,
Cases with 1, 2 or 3 third molars erupted	886 or 25·5 ,,

Such figures, taken by themselves, would be rather misleading, as the obvious assumption is that under fifty per cent of the men have all third molars erupted.

A further analysis of these 3,510 cases by ages gives the following results :—

1,993 were between 18 and 20
1,035 were between 21 and 25
482 were above 25

Ages 18 *to* 20—

Cases with all four molars erupted or in process of eruption ..	535 or 27·0 per cent
Cases with all four molars unerupted	848 or 42·5 ,,
Cases with 1, 2 or 3 molars erupted	610 or 30·5 ,,

Ages 21 *to* 25—

Cases with all four molars erupted or in process of eruption ..	689 or 66·5 per cent
Cases with all four molars unerupted	127 or 12·0 ,,
Cases with 1, 2 or 3 molars erupted	219 or 21·5 ,,

Ages above 25—

Cases with all four molars erupted or in process of eruption ..	409 or 84·8 ,,
Cases with all four molars unerupted	16 or 3·4 ,,
Cases with 1, 2 or 3 molars erupted	57 or 11·8 ,,

How do these figures compare with those given in the modern text-books? It is noted above that the dates of eruption of the third molars according to Norman Bennett were between 17 and 25. Mummery gives the eruption of the maxillary molar at the 17th to 20th year, and further states that the eruption of the mandibular teeth usually precedes that of the maxillary teeth.

The range of eruption given by Norman Bennett is so wide—17 to 25—that any statistics would be expected to show that eruption took place within these ages. Mummery has been more definite in giving the ages as 17 to 20. This would appear to be rather on the early side, as only twenty-seven per cent had all four molars erupted and forty-two per cent showed complete absence.

In no case could I find any definite statistics as to the probability of eruption, and if any real value is to be given to this tooth it is necessary to establish some more accurate data.

All statistics are open to criticism and cannot be accepted as permanent but, at any rate, they can provide a basis for establishing a reasonable theory. If, therefore, these figures can be taken as any indication of the general oral condition of the recruit, it would not be unreasonable to make the following deductions:—

(i) The probability of eruption of all third molars is over eighty per cent and of complete absence is under five per cent.

(ii) The dates of eruption are between 18 and 25, the most common period being between 20 and 22.

The next consideration is, what value can be placed on this third molar? My contention is that the popular idea of the wisdom tooth—that it is abnormal, more often impacted than otherwise, and generally associated with some complications—tends to undervalue it.

An examination was made in detail of the 886 cases with first, second or third molars.

The following figures were obtained:—

	Present	Missing	Unerupted	Erupting	Impacted
Upper right third molar ..	300	9	530	47	—
Lower right third molar ..	254	7	514	110	1
Upper left third molar ..	298	16	530	42	—
Lower left third molar ..	271	10	494	110	1

It is very interesting to note that, out of these 886 cases, an equivalent of 3,544 possible third molars, only 2 or 0·06 per cent were impacted. This figure is quite contrary to expectations and does not in any way agree with

Norman Bennett's statement that "the mandibular third molar is, of all teeth, by far the most imperfectly erupted and that a large number never arrive at a condition of complete eruption."

On the other hand, the above figures give the upper third molars a higher percentage of eruption than the lower. If, however, we include the figures for teeth erupting and, in view of the fact that they are not impacted it can be presumed that they will fully erupt, we find that the lower molars have a higher percentage than the uppers.

The percentage of unerupted third molars is high, but, out of a total of 2,068, 1,465 were in men between the ages of 18 and 20, and it can be presumed, if the previous figures are to be taken as any criterion, that at least eighty per cent of these will erupt at a later date.

The number of third molars missing by extraction is remarkably low. This is what one would expect from any figures which included such a large proportion of men under 20, but an analysis of the 376 cases of men of 21 and above showed that out of a possible 1,104 third molars only thirty-one or 2·8 per cent were missing by extraction.

Whilst this investigation was in progress it was suggested that it might be of advantage to ascertain the relationship of the presence or absence of the first molar to the eruption of the third molar in normal position. The theory has been advanced that in certain suitable cases the early extraction of the first molar will increase the chances of a fully erupted third molar.

Out of 3,962 third molars erupted, it was found that in 1,782 cases or forty-five per cent the first molar was present, and in 2,180 cases the first molar was absent.

Only those who have been carrying out investigations into this theory would be entitled to draw conclusions from these figures. They are therefore put in for information.

It is customary in writing a paper of this description to complete it by stating definite opinions founded on the investigations and, until they are proved to the contrary, hope that they will be accepted as facts.

I am not making any such claim. I have drawn certain tentative conclusions, but I do not in any sense put them forward as facts.

The men who have been examined are all drawn from one particular class, who are, as Army recruits, presumably of the best physical standard.

It is, however, distinctly noticeable that the third molar amongst this type of man appears, from these figures, to assume a more normal and useful role than that which is met with in private practice.

One has only to be a constant reader of the recognized dental journals to realize that the third molar is a continual source of trouble, both to the patient and the dental surgeon.

Is there, therefore, any connection between the eruption of the third molar and the type of life led by the different classes of people? In the first place there is the Army recruit, drawn from a class whose dental standard is notoriously low, whose diet and mode of life is of a haphazard

nature, and with whom, very often, the dentition existing between the ages of 18 and 20 has been arrived at as the result of the very simple rule of the survival of the fittest.

On the other hand you get the patients of private practitioners, who are drawn from a class who habitually look after their teeth, make every effort to save them as long as possible and whose diet and mode of life would be expected to add to their general efficiency.

Is there anything in this theory? It is put forward purely as a conjecture and can only be left as such for the experienced research worker to decide.

Though it is realized that the numbers dealt with in this investigation are small, it is hoped that these figures may help towards establishing the wisdom tooth as a really useful member of the human dentition and, still further, be of help to those who are investigating the causes and prevention of impacted third molars.

In conclusion, I would like to express my thanks to Major-General H. C. R. Hime, C.B., D.S.O., M.B., K.H.P., who instigated the investigation on which this paper is founded and gave me very great encouragement, and to the officers of The Army Dental Corps in the Southern Command who so willingly did all the work.

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THE DOCTOR'S WAR, 1899-1902.

By D.A.D.M.S.

(*Continued from p.* 28.)

The situation now hinged on where the Boers would make their next stand and everything pointed to the Modder River. Information reported both the Modder and Riet Rivers in flood, and that Remington's Scouts, an irregular Corps of Mounted Infantry, who wore a picturesque headgear of soft slouch hat with a band of spotted skin, so-called Remington's Tigers, also reported that the Boers were strongly entrenched on the *South* bank of the River. This latter bit of information was heatedly discussed after the battle as the truth, or otherwise, of such a report was of the utmost importance. The advance on November 28 was like this. The screen of mounted patrols moved off at first streak of dawn about 5 a.m., the transport inspanned, and the infantry, in long serpentine lines, started out over the parched veldt. The wagons follow four abreast spread out over the plain, with their escort marching on each side. Not much notice is taken of the so-called road, which is just a track on the hard-baked ground. Away out in front is Modder River, and on the right the Riet River, where it branches off from the parent stream. In the centre of the position would be the railway bridge, sure to be destroyed, and the ford, or drift, below the bridge reported impassable from the flooded condition of the river. We have to reach water, we have to get to Kimberley, we have to push on, we cannot sit down on a barren waterless plain and wait for a flooded river to subside. So the British Army marched grimly on to meet the foe they had twice defeated in that same week. The supplies and ammunition came puffing along behind on the rails. The Ambulance Train followed on. Rather an odd sort of war it now seems, marching straight on up the line from one station to the next, not knowing at what station Brother Boer would refuse to clip our tickets and let us through to Kimberley! So we plodded slowly on, and presently the sun rose and blazed down on us, and it was very hot. Then firing began. All the troops were now in extended order, and we could see line after line disappearing over our immediate horizon of heat and haze. So we halted and waited. The firing rose to a crescendo of rolls of musketry and would die away again. We saw shells bursting and heard guns firing, but that was nothing, it was the sustained rifle fire that seemed to go on and on. All that hot day we waited. No orders came to unpack and open up our Field Hospital. At times we heard something like a giant machine gun. It sounded pom-pom-pom-pom. We learned later, by experience, it was a quick-firer, pouring out a stream of one-pound shells, and very effective, not to say nerve-racking. Somebody wrote about it under the name of "A Ballade of Ten-a-penny."

"'POM-POM-POM'—and the shells have flown;
'BANG-BANG-BANG'—without rise or sink—
Accurate sameness to half a tone—
Whizzing one-pounders—don't stop to think,
Open the ranks like a 'speilers' wink.
This is a speedy and frolicsome bomb,
Do not despise it, but do not shrink.
This is a nerve test, this swift pom-pom."

Our O.C. rode forward to find out what he could. He came back somewhat gloomy and told us we seemed to be held up. The Boers were firmly entrenched, and our infantry came under a withering fire as they approached the thin line of low bushes fringing the river. There was absolutely no cover; nothing on that bare expanse of veldt but the scattered ant-bear heaps, smooth, round excrescences dotting the plain. White marks on these heaps showing towards the river taught us that the enemy had carefully marked off the ranges and had only to wait for each successive wave of men to come to the marked area to have the exact range. Our men could do nothing but lie down and scoop up what little protection they could. Some time during the afternoon part of the Highland Brigade arrived and pushed forward. They met the same fate and had to halt and lie flat. Hence the fact that many of them became casualties from getting the tender-skinned back of the knees burned by the sun as they lay prone. Somewhere on the left our Naval 4.7 guns were firing lyddite shell at the Boer positions across the river. One could see the big black burst of the shell. I believe this stuff produced very acrid yellow fumes which stained the skin, and made people feel sick. The Boers were said to carry bottles of vinegar to inhale and rub on the skin, but I cannot vouch for this. I never saw any Boer wounded stained yellow, and I rather imagine the effect of the shell was much the same as the high-explosive in the Great War. At one time in the afternoon our Field Hospital was moved back as shells were bursting fairly closely. Towards the end of the day we received orders to open up, and wounded commenced to trickle in. I remember seeing Lord Methuen being brought in wounded, he had been shot through the fleshy part of the thigh and had a narrow escape. As it was he refused any question of evacuation, and was only a few hours or days in hospital. It soon became evident that we were held up and the battle seemed to settle down to a stalemate. But unknown to us at the time, some of our infantry had forced a way over the Modder and gained a holding on the northern bank. At any rate, the enemy did as the Arab. After the cares that had certainly infested the day of battle, he waited until night fell, and then silently stole away. When dawn broke the Modder was in our possession, and another fence on the way to Kimberley was down. Four officers were killed and nineteen wounded at the Modder fight. Amongst the wounded was Captain Guise-Moores, of the R.A.M.C. Lord Methuen in his dispatch said, "Again I call attention to the splendid hospital arrangements, for at

4.45 p.m. on the day after the fight, all my wounded were on the way to Cape Town. I am glad to have been slightly wounded, because in no other way could I have learnt the care taken of the wounded; and there was nothing officer or soldier required that was not provided at once, and the Medical Officers never tired in their endeavours to alleviate suffering." It was the fashion of the time to express feelings in poetry, and in the *Morning Post* the following lines appeared after, if perhaps a long way after, the Kipling style:—

> "But here's to the man of the R.A.M.C.,
> Buzzing about on the field like a bee,
> Tending the wounded where lead's flying hot,
> Biting his lip when he gets himself shot;
> Brave as the best of us, hurt and not tell,
> Doctor he may be—he's soldier as well."

After this strenuous week of battles, Belmont, Graspan and Modder River, we settled down for a general tidy up and re-fit. We pitched our field hospital on a site over the river and not very far from the hub of life, i.e. the local hotel, which rapidly became the sort of central club and gathering place in the late afternoons. Here one heard all the chat and rumours, all highly coloured and thoroughly unreliable. One of the japes was that Cecil Rhodes was sending helio messages from Kimberley to ask if we were building stone houses or huts at the Modder. Any cloudy evening the searchlight from Kimberley was dot-dashing in the sky, and we were replying. Between us, at Magersfontein, the next fence to be jumped, sat General Kronje and his Boer Army. He also joined in the game of playing his searchlight in the sky to confuse the messages. Our Naval guns had moved up and were plugging lyddite shell at that long low range of hills where Kronje sat. It was part of the day's excitement to go up to the gun positions, where cheery and obliging Naval officers would let you look through their fixed telescopes and watch the enemy's trenches stretching along the bottom of the kopje. One could plainly see Burghers moving about on the hillside, but at the bang of our 4·7's all would go to ground like rabbits. Then a pause, and a puff of smoke on that distant hill; and a shell would come over in our direction. But the firing was desultory on both sides and little damage was done. So we waited, and both sides strengthened themselves for the next struggle. But it was not for long. On the night of December 10 we moved off with the transport. It was a bad night, dark as pitch with rolls of thunder and heavy rain. We went very slowly and I sat and dozed on my pony, got off and walked, and just kept awake. Our Transport N.C.O. rode a white horse, and once as he passed me I saw him miraculously vanish from sight and his white pony pass on into the darkness. I also heard language. Groping my way towards his direction, I found him seated on the ground and cussing all sappers who had plucked him from his seat with a field telegraph wire stretched from invisible poles.

When the blue of night merges into the grey of day, and just before the dawn, a hellish burst of fire tore the night apart. It was sustained, severe rifle fire and it went on for some time, half an hour perhaps, then it eased down to a steady, even sort of noise, with an occasional sharp spurt. Not a sound of a gun, all rifle or machine-gun fire. Then it all ceased. We moved on. The rain was over. It was the bright early morning of the South African veldt. The air pure and clear and exhilarating. I suddenly saw a soldier seated on a small ant-hill some short distance away. I got on my pony and rode over to him. He was a young soldier, not a reservist, of the Highland Brigade. He had no helmet, no rifle and no equipment. I asked him what he was doing there and where was his battalion. He looked at me in a dazed sort of way and said, in a strong Scotch accent: "All the battalion is wiped out, and all the officers is killed." I led him back to the wagons and gave him a lift. As we moved forward we saw more men sitting about, and one got the same story of some sudden disaster to the Highland Brigade. It was now quite clear, and one could see the line of kopjes in front. Now they looked quiet and perfectly silent. Wounded Highlanders were being collected and we rapidly organized a dressing station, preparing plenty of hot bovril for the exhausted men. Also parties of men under an officer would turn up looking for drinking water, and our water cart was kept busy supplying them. I went forward with a stretcher party as it was obvious the Bearer Company had much more work than they could cope with. We worked right up towards the kopjes and eventually reached a wire fence where dead soldiers were hanging. Many wounded were scattered about. Quite suddenly we came on a group of dead civilians, as they seemed to us, big men dressed in plain clothes but most of them wearing long field boots. One was still alive and we picked him up. They were Scandinavians who formed a special contingent of the Boer Army. It was said they had joined Kronje the night before and had been detailed to act as an advance patrol or listening post. Anyhow, they had struck the Highland Brigade somehow and had been wiped out. We were told an armistice had been arranged to allow us to collect our dead and wounded. I know that the silence was suddenly broken by our Naval guns opening up, and there was some suspense lest the Boers would open fire on our collecting parties, which they were perfectly justified in doing. Some error had been made in not getting a message through to the guns back at Modder; it was soon rectified, and the Boers made no sign. I was close enough up to see the Boer trenches winding along at the base of the kopjes, or rather well in front of the rocky background. This was obviously a better place for their first line of defence, as our guns hitting the rocky outcrops broke them up and scattered fragments far and wide. But one could also see defences further up the hillside. Once or twice I saw well-dressed Boers, looking like officers, walking about in an unconcerned way. They wore riding breeches and leggings or field boots, ordinary sporting sort of tweed coat, slouch hat, bandolier full of ammunition, and carried

Mauser rifles. They looked like the ordinary sporting type of farmer one might see at home. They did not interfere with us in any way.

It was during this period of armistice that one of our R.A.M.C. officers got himself into some trouble. It was said he rode forward to help in the work, and, having dismounted, left his horse to a groom to look after. One of the young men I have described above had a look at that horse and noticed a revolver butt sticking out of the holster. He asked the groom in good English whose horse it was. The groom pointed to the medical officer and said: "That bloke over there," or words to that effect. The young Boer strolled over to Major B. and started chatting. Presently he pointed to the horse and said: "Nice beast that. Your property?" Major B. said: "Yes, my horse." "Let's have a look at him," suggested the Boer amicably. As they reached the horse the Boer pointed to the revolver and remarked: "That yours also?" Major B. saw the trap he had fallen into and said: "Oh, yes, I carry that for shooting wounded horses or mules." "Well, well," said his captor, "fancy that now, a medical officer with a revolver, and we supposed to be fighting under the Geneva Convention; better come along and see the Commandant." The story goes that Major B. was handed over to some German doctors who took him round their field hospital and put him through an unofficial medical examination. They evidently reported he was a medical man and he was safely returned some days later. I wonder what would have happened to him in the Great War under similar circumstances?

When we had picked up all the wounded we could see we made our way back to our Dressing Station. We found it busy and somewhat embarrassed by the continual arrival of slightly wounded or merely sympathetic soldiers who were helping in the good work. The history of the early morning attack was constantly repeated. It is told in a few words.

The Highland Brigade was advancing in quarter column just as dawn was breaking. The line of hills loomed up in front and the order was given to extend when the whole base of the hill lit up with the flashes of a hurricane rifle fire poured into that dense mass of men at close range. A story was told of lamps on the flank of the attack being flashed as a warning to the enemy. The shock to the Brigade was immense. Men fell in swaths. One bullet may easily have stopped several men, fired into the brown like that. It was said there were confused calls of "Advance" and "Retire." Some tried to get forward, some were forced back, and the bullets lashed on them like hail. The attack had failed. The Brigade Commander, General Wauchope, was killed. Later in the day a second attempt was made to attack the enemy position, but it was also held up, and it was not a very strong attempt. The Boer guns began to get active and it was decided to move back to our camp (which had been left standing) at the Modder River. Slowly we moved away, not hurrying in the least, though the Boer shells were falling thicker now. It was strangely

like a wounded animal turning his back on his enemy to lick his wounds and rest himself for the next fight. It was a sullen menacing retirement. I wonder what the Boer thought as they watched us. At any rate they made no attempt to follow us. I expect old Kronje had his coffee and telegraphed to President Kruger at Pretoria to say, "The war is over. Englishmen beaten and on their way back to Cape Town to their ships." But we only went back to the Modder River, carrying our wounded—and dead—with us. Next day was the saddest I can remember of the whole war. All day the Highland Brigade buried their dead. General Wauchope was laid to rest by the men of the Black Watch. Two large graves running North and South, gave resting-place to the men of the Brigade, and at right angles to them rested many of their officers. Chaplain Robertson laid officers and men to rest with the simplicity of a Presbyterian graveside service, and then the mournful strains of the pipes in "Lochaber no more." We were back in our tented Field Hospital once more.

Some very interesting things were written in the Home papers after the battle of Magersfontein. Under the title of "The Moral of this War," Julian Ralph wrote as follows: "Magersfontein seems likely to be the end of the Chapter of War as practised by the Wellingtons, Wolseleys, Von Moltkes and Grants. Given a plain field, modern magazine rifles, and quick-firing small guns, the whole German Army could not dislodge the entrenched 65,000 men of the Boer Republics. If Germany got in a trench that could not be turned, all the world could advance and be slaughtered, but not all the world could oust the Germans from that trench." Somewhat prophetic words written at the Modder River at the end of 1899.

I would like to hark back to the evening of that December 11. I had returned with my stretcher party to the Field Hospital. Weary but excited at having been under fire for the first time I was met by the sergeant-major, who eagerly informed me that a staff officer wearing kilts had visited the hospital and asked for the name of the officer of the unit he had seen collecting wounded under fire. I asked was he sure he was a staff officer. "Oh, certain, sir, of course they don't wear distinctive dress now, but he was dressed in a Highlander's uniform and spoke as if he was on Lord Methuen's staff." I was greatly bucked at this, and had already seen my name in despatches for a D.S.O., when the sergeant-major came running up again. "Here he comes again, sir." I dashed out of the tent to meet this important person—and saw a certain M.O. of one of the battalions in the Highland Brigade who affected the wearing of the uniform of the battalion instead of R.A.M.C. kit, and was greeted with a request for cigarettes and nourishment. I was delighted to see him and gave him both.

The Army settled down again at the Modder. The Divisional Field Hospital soon began to fill up. Many cases of a sort of colitis occurred, said to be due to the heat, dust and sandy grit in the drinking water, and nick-named "The Modders." I do not think we had any clarifying

plant in those days, I mean on a big scale, though many of us used Berkefeld filters, and I know the candles were brown with dust after a few pumpings. Our gallant O.C. spent much time in a very hot tent developing photographs from his cinema-camera. He got some excellent photos of long spans of oxen dragging naval 4.7 guns into position for shelling Magersfontein.

We settled down to a life of routine. I remember a sort of reconnaissance in force towards the Boer position which stirred up the somnolent hills and drew pretty smart fire, showing us that brother Boer was still there. Our opposite numbers, the Bearer Company, sat down near us and occupied themselves in collecting sick and bringing them to us. Having done that they rested for the day. As we got busy they still rested. Their job was to collect wounded under fire and, at a pinch, sick people when actual fighting was not going on. I do not know how long this absurd system remained in force as I left the hospital to become medical officer to a mounted infantry unit, the 2nd Mounted Infantry, and that begins a new story of movement and fighting, and various adventures.

A TOUR OF THE BATTLEFIELDS IN FRANCE.

By Colonel A. N. FRASER, D.S.O.,
Royal Army Medical Corps.

Under the direction of Major-General J. A. Hartigan, C.B., C.M.G., D.S.O., K.H.P., Deputy Director of Medical Services, Aldershot Command (now Director-General, Army Medical Services), a most successful Tour of the Battlefields was arranged for Royal Army Medical Corps officers from Aldershot.

In the past, tours of the battlefields have been confined to officers of the combatant branches of the Services, and now that Aldershot has had a tour for R.A.M.C. officers only, it is hoped that other Commands will follow the excellent precedent thus established.

The Directing Staff consisted of Major-General Hartigan, Deputy Director of Medical Services, Aldershot Command; Colonel J. P. B. Robinson, C.M.G., D.S.O., Assistant Quartermaster-General, Aldershot Command; Lieutenant-Colonel A. E. Stokes-Roberts, O.B.E., M.C., General Staff Officer, 2nd Grade, Aldershot Command; and Lieutenant-Colonel A. N. Fraser, D.S.O., R.A.M.C., Assistant Director of Hygiene, Aldershot Command.

The preliminary arrangements for transport, hotel accommodation and passes were in the hands of Lieutenant-Colonel Stokes-Roberts.

The officers detailed for the tour (eleven in number) were selected from officers who had not served in the forward areas in France during the Great War, and they were instructed to study Chapters II, IV, XI and XIV of the Official History of the War, Medical Services, vol. iii.

Maps were issued three weeks prior to departure for France, and two conferences were arranged for the purpose of explaining the objects of the tour, and marking on the maps the lines held by the British at the Battle of the Somme, July 1, 1916, the battle of Arras, April 9, 1917, the battle of Cambrai, November 20, 1917, and the line on March 21, 1918, prior to the retreat. The positions of casualty clearing stations, stationary hospitals, motor ambulance convoys and main dressing stations were also marked on the maps. The D.D.M.S. explained the general scheme of evacuation in each phase of the campaign, Colonel Robinson gave a very lucid explanation of the "Q" work, and Lieutenant-Colonel Stokes-Roberts discussed the "G" point of view.

The whole idea of the preliminary study of the Medical History of the War, and of the conferences in Aldershot, was to ensure that all attending the exercise had a general knowledge of the phases of the campaign which were being specially dealt with, to reduce to a minimum set lectures in France, and thereby leave the maximum time for discussion on the actual ground.

The party left Aldershot at 6.15 a.m. on Sunday, July 23, 1933, by

char-a-banc for Victoria, thence to Folkestone and Boulogne, where we lunched before our departure by char-a-banc for Arras, our headquarters during the tour.

On the road to Arras we passed through Etaples, Montreuil, Hesdin, St. Pol, Aubigny, Hautes Avesnes and Agnez les Duisans, and from St. Pol onwards the D.D.M.S. explained the medical situation and arrangements for the battle of Arras, and pointed out the sites of the casualty clearing stations and main dressing stations.

On Monday, July 24, the original intention was to "do" the battle of Arras and visit the caves; as a preliminary to this, Lieutenant-Colonel Stokes-Roberts explained the preparations carried out prior to the attack and Colonel Robinson went into the question of refilling points, supply of ammunition and transport arrangements. Unfortunately the visit to the caves could not take place at the original hour arranged and the D.D.M.S. decided to visit the Somme area, and study the battle of the Somme, 1916.

We left via Ronville where an Advanced Dressing Station was established for the Arras battle, and travelling south, close to Ficheaux, we passed Boiry St. Rectrude, where in the later stages of the battle of Arras the VIIth Corps had a main dressing station, thence through Ayette, where Colonel Robinson was in the final offensive of 1918, to Pusieux au Mont and Serre reminiscent of most fierce fighting, which was graphically described by Lieutenant-Colonel Stokes-Roberts before going on through Auchonvillers to Newfoundland Farm, almost due north of Hamel.

At this point, where the war memorials of the Newfoundland Brigade and the 51st Division overlook Beaumont Hamel, we were given an account of the battle, with special reference to the 29th Division, and were reminded of the fact that during this period tanks made their first appearance at Flers.

Major-General Hartigan explained the medical arrangements, pointing out the difficulty in disposing of the very large number of casualties incurred on the first day of the battle of the Somme.

We then visited the trenches, which have been preserved, in Newfoundland Farm, in the vicinity of Y ravine and after lunch at Hamel visited Thiepval War Memorial.

In the afternoon we studied in more detail the medical arrangements of the XIIIth Corps which occupied the right of the British line at the battle of the Somme, following the route of the wounded man from the front line to the Casualty Clearing Station. We visited Fricourt, Mametz, Montauban, Boufay Farm, Bray sur Somme, Dives Copse to Corbie and La Neuville where the casualty clearing stations were located.

We returned to Arras through the back areas via Querrieu, where General Rawlinson's 4th Army Headquarters were located, Villers Bocage and Beauval, site of a casualty clearing station, thence to Doullens, leaving on our left Gezincourt, where there were two casualty clearing stations.

Passing through Doullens, where in the Citadel there was a casualty clearing station, we saw the unpretentious hostelry, Le Quatres Filles, where the momentous decision was made that Marshal Foch would be Generalissimo of the Allied Forces. Our road from this point to Arras took us through Mondecourt, the headquarters of a motor ambulance convoy, Warlincourte Halte, where there were two casualty clearing stations on the south of the road and one in a chateau on the north side of the road to which the wounded of the Left Corps in the battle of the Somme and the Right Corps in the battle of Arras were evacuated, and Larbret where, for a short time during the Arras battle, there was a main dressing station.

On Tuesday, July 25, the D.D.M.S. described the medical arrangements for the battle of Arras and paid tribute to the D.M.S. 3rd Army, Major-General Sir Murray Irwin. Lieutenant-Colonel Stokes-Roberts told us of the preparations for the battle, the weather conditions, the preliminary cutting of wire by intensive artillery bombardment and of the tunnelling and mining operations.

We then proceeded to Monchy le Preux, halting on the way at Tilloy to have the earlier phase of the Arras battle explained, and here the D.D.M.S. went more fully into the medical arrangements of the VIth Corps and by his description of a gas attack emphasized the importance of gas discipline.

From Monchy we went to Roeux where a most interesting description was given by the D.D.M.S. of the evacuation by rail, canal and road to St. Nicholas and Haute Avesnes. Gavrelle, the furthest point reached in the battle of Arras, was then visited and we returned to Arras via Thelus and Vimy Ridge.

A visit to the famous Arras Caves followed and in these underground vaults we saw how the Divisions had been housed prior to the attack; similar caves housed the well-known Advanced Dressing Station for the VIth Corps. Apart from the original caves, formed by the removal of stone for the building of Arras, one saw communicating galleries constructed by tunnelling companies, remains of the extensive electric lighting and the sanitary arrangements.

In the evening the majority of the party visited, under private arrangements, the Canadian War Memorial and the trenches which have been maintained by the Canadians at Vimy Ridge. This visit was of great value as the dug-outs have been well preserved and gave one a very good conception of a trench system.

On Wednesday, July 26, at the usual early morning conference, a trench map was shown and explained, after which the events leading up to the battle of Cambrai were dealt with by Lieutenant-Colonel Stoke-Roberts.

As is well known, the secret of the attack at Cambrai was very carefully kept, including the very difficult concentration of tanks at Havrincourt. This attack differed from others in that there was no preliminary artillery bombardment and we depended on the tanks to flatten out the German wire.

The extensive preliminary training carried out by the tanks co-operating with Infantry was fully dealt with. The D.D.M.S. then explained the secret of the preliminary medical arrangements and with what care these had to be carried out in case those not aware of the impending battle should become cognisant of the state of affairs. After describing from a medical aspect the battle of Cambrai, Major-General Hartigan gave a most interesting talk on the final German offensive in 1918 with special reference to the 19th Division (3rd Army).

Whilst we can read of this offensive and our retreat in the various official histories, nothing impresses itself so much on one's brain as a word picture by an eye witness given on the actual ground, and the lessons learnt from the retreat as described to us will remain much more clearly than if we had read innumerable textbooks.

After the conference we proceeded to Flesquieres via Bapaume, Ruyalcourt—M.D.S., Ytres—C.C.S. group, Neuville, and Ribecourt. At Flesquieres, Lieutenant-Colonel Stokes-Roberts dealt with the Cambrai battle and by a series of map tracings made each stage in the fighting very easily understood.

Unfortunately visibility on this day was poor and as the crops had not been cut it was difficult to pick up landmarks. Even the position of the Hindenburg Line could not be identified with certainty.

After lunch at Flesquieres the return journey followed the line of the retreat of the 19th Division, halting first at Doignies where with one of the trench maps actually used during the attacks the two attempts to recapture that village were discussed.

We then passed through Bapaume, Grevillers, Irles, Achiet le Petit, Bucquoy and Ayette and so to our Headquarters, the Hotel de l'Univers, Arras.

Thursday, July 27, meant an early start as, by the courtesy of our Director, instead of returning direct to Calais we were taken north past Vimy Ridge, Lens, Loos, Neuve Chapelle and Armentières. At Messines Colonel Robinson described the capture of the Ridge in 1917. Next we visited Ypres and after passing through the Menin Gate the D.D.M.S. at the Hooge Chateau gave a brief description of the days spent in the Ypres Salient. Vlamertinghe, Poperinghe, Remy Siding and St. Omer lay on our road to Calais and so to Dover, the tour over.

Glorious weather and a calm sea favoured us and what at one time seemed a formidable task was completed without any untoward incident.

The tour was not only a great pleasure to all taking part but was most valuable from the lessons learnt. It is to be hoped that, though this was the first tour of its kind for Royal Army Medical Corps officers, it will by no means be the last.

to 20th year and eruption of the mandibular teeth usually slightly precedes that of the maxillary teeth."

Norman Bennett gives the ages of eruption as 17 to 25 years.

Into this uncertainty and ambiguity is it possible to introduce any greater degree of accuracy? Is this third molar of any value or not, comparable with the remainder of the teeth?

In private practice, dental standards—as the Army knows them—are non-existent. The patient, if willing, is given the best treatment the dental surgeon considers necessary to render him as effective as possible, though, in certain cases the financial question does intervene, thus making it necessary to adapt the treatment to the financial ability of the patient.

This is not exactly the case in the Army. Here a definite dental standard is laid down, which is the minimum required for a man of the necessary physical condition, and this standard is largely based on molar occlusion.

It is essential, therefore, in estimating the dental condition of a recruit, that full value should be given, not only to the existing teeth, but for any future eruption of the third molars that might take place.

Only too often, one finds that recruits of a perfect physical standard fall short of the required dental standard. In these cases it has been my practice to give full value for unerupted third molars—but the question arises, what value is one justified in giving?

It was a case of this nature that started this investigation. A recruit of 18, who had been accepted, was found to be below the prescribed dental standard and, in the course of time, he was recommended for the supply of dentures. I did not concur in this recommendation in view of the fact that the third molars were not erupted, and I considered that it would be advisable to wait for further developments.

Major-General H. C. R. Hime, then Deputy Director of Medical Services, Southern Command, took the greatest interest in this case and, before dealing with my recommendation, asked me what grounds I had for assuming that the third molars would erupt, and also at what age they could be expected.

In view of the quotations I have given above, it is not surprising that I had no definite information on the subject but was relying on a general average.

I presumed that the majority did have third molars and that they erupted between the ages of 18 and 20. I also added that, during the time I was Senior Dental Officer at Woolwich, I had examined about 20,000 recruits, and one of the things I had particularly noticed was the fact that a large proportion of the men had well-formed third molars.

It was then suggested that, in view of the very important part the eruption of the third molars appeared to play in the estimation of the dental condition of the recruit, it would be of advantage if I carried out an investigation to see if any definite information could be obtained. A cir-

cular was therefore sent out to all dental officers in the Command enclosing the following pro-forma for completion in respect of all men presenting themselves for treatment.

Index No.	Age	Upper R. 3rd Molar	Lower R. 3rd Molar	Upper L. 3rd Molar	Lower L. 3rd Molar

. In completing columns 3, 4, 5 and 6, the following symbols were used :—

"P" = Molar present and in good position.
"E" = Molar erupting within the next three months.
"I" = Molar present but impacted.
"A" = Molar absent and no sign of eruption.
"M" = Molar missing through extraction.

This investigation was carried out over a period of four months and 3,510 cases were examined. This number is not very large when one considers the size of the population, but the investigation gave officers an extra amount of work and, in view of the fact that dental officers are already kept fully occupied, it was not considered desirable to continue this additional work longer than was necessary.

I should like, at this juncture, to express thanks to all dental officers in the Command for the very careful way in which the figures were compiled.

Although the number of cases is small, the figures given represent a possible total of 14,000 third molars and they also have a great value for the following reasons :—

They were not compiled by one officer, but by fourteen different officers scattered over the Command. The men examined were not taken from one district, but were representative of the whole of the recruiting area for the Army, and include men from town and country districts. They therefore have a more general application than a similar number of cases examined in one district only.

The following is an analysis of these 3,510 examinations :—

Cases with all four third molars erupted	1,633 or 46·3 per cent
Cases with all four third molars unerupted	991 or 28·2 ,,
Cases with 1, 2 or 3 third molars erupted	886 or 25·5 ,,

Such figures, taken by themselves, would be rather misleading, as the obvious assumption is that under fifty per cent of the men have all third molars erupted.

A further analysis of these 3,510 cases by ages gives the following results :—

1,993 were between 18 and 20
1,035 were between 21 and 25
482 were above 25

Ages 18 *to* 20—

Cases with all four molars erupted or in process of eruption ..	535 or 27·0 per cent
Cases with all four molars unerupted	848 or 42·5 ,,
Cases with 1, 2 or 3 molars erupted	610 or 30·5 ,,

Ages 21 *to* 25—

Cases with all four molars erupted or in process of eruption ..	689 or 66·5 per cent
Cases with all four molars unerupted	127 or 12·0 ,,
Cases with 1, 2 or 3 molars erupted	219 or 21·5 ,,

Ages above 25—

Cases with all four molars erupted or in process of eruption ..	409 or 84·8 ,,
Cases with all four molars unerupted	16 or 3·4 ,,
Cases with 1, 2 or 3 molars erupted	57 or 11·8 ,,

How do these figures compare with those given in the modern text-books? It is noted above that the dates of eruption of the third molars according to Norman Bennett were between 17 and 25. Mummery gives the eruption of the maxillary molar at the 17th to 20th year, and further states that the eruption of the mandibular teeth usually precedes that of the maxillary teeth.

The range of eruption given by Norman Bennett is so wide—17 to 25—that any statistics would be expected to show that eruption took place within these ages. Mummery has been more definite in giving the ages as 17 to 20. This would appear to be rather on the early side, as only twenty-seven per cent had all four molars erupted and forty-two per cent showed complete absence.

In no case could I find any definite statistics as to the probability of eruption, and if any real value is to be given to this tooth it is necessary to establish some more accurate data.

All statistics are open to criticism and cannot be accepted as permanent but, at any rate, they can provide a basis for establishing a reasonable theory. If, therefore, these figures can be taken as any indication of the general oral condition of the recruit, it would not be unreasonable to make the following deductions:—

(i) The probability of eruption of all third molars is over eighty per cent and of complete absence is under five per cent.

(ii) The dates of eruption are between 18 and 25, the most common period being between 20 and 22.

The next consideration is, what value can be placed on this third molar? My contention is that the popular idea of the wisdom tooth—that it is abnormal, more often impacted than otherwise, and generally associated with some complications—tends to undervalue it.

An examination was made in detail of the 886 cases with first, second or third molars.

The following figures were obtained:—

	Present	Missing	Unerupted	Erupting	Impacted
Upper right third molar ..	300	9	530	47	—
Lower right third molar ..	254	7	514	110	1
Upper left third molar ..	298	16	530	42	—
Lower left third molar ..	271	10	494	110	1

It is very interesting to note that, out of these 886 cases, an equivalent of 3,544 possible third molars, only 2 or 0·06 per cent were impacted. This figure is quite contrary to expectations and does not in any way agree with

Norman Bennett's statement that "the mandibular third molar is, of all teeth, by far the most imperfectly erupted and that a large number never arrive at a condition of complete eruption."

On the other hand, the above figures give the upper third molars a higher percentage of eruption than the lower. If, however, we include the figures for teeth erupting and, in view of the fact that they are not impacted it can be presumed that they will fully erupt, we find that the lower molars have a higher percentage than the uppers.

The percentage of unerupted third molars is high, but, out of a total of 2,068, 1,465 were in men between the ages of 18 and 20, and it can be presumed, if the previous figures are to be taken as any criterion, that at least eighty per cent of these will erupt at a later date.

The number of third molars missing by extraction is remarkably low. This is what one would expect from any figures which included such a large proportion of men under 20, but an analysis of the 376 cases of men of 21 and above showed that out of a possible 1,104 third molars only thirty-one or 2·8 per cent were missing by extraction.

Whilst this investigation was in progress it was suggested that it might be of advantage to ascertain the relationship of the presence or absence of the first molar to the eruption of the third molar in normal position. The theory has been advanced that in certain suitable cases the early extraction of the first molar will increase the chances of a fully erupted third molar.

Out of 3,962 third molars erupted, it was found that in 1,782 cases or forty-five per cent the first molar was present, and in 2,180 cases the first molar was absent.

Only those who have been carrying out investigations into this theory would be entitled to draw conclusions from these figures. They are therefore put in for information.

It is customary in writing a paper of this description to complete it by stating definite opinions founded on the investigations and, until they are proved to the contrary, hope that they will be accepted as facts.

I am not making any such claim. I have drawn certain tentative conclusions, but I do not in any sense put them forward as facts.

The men who have been examined are all drawn from one particular class, who are, as Army recruits, presumably of the best physical standard.

It is, however, distinctly noticeable that the third molar amongst this type of man appears, from these figures, to assume a more normal and useful role than that which is met with in private practice.

One has only to be a constant reader of the recognized dental journals to realize that the third molar is a continual source of trouble, both to the patient and the dental surgeon.

Is there, therefore, any connection between the eruption of the third molar and the type of life led by the different classes of people? In the first place there is the Army recruit, drawn from a class whose dental standard is notoriously low, whose diet and mode of life is of a haphazard

nature, and with whom, very often, the dentition existing between the ages of 18 and 20 has been arrived at as the result of the very simple rule of the survival of the fittest.

On the other hand you get the patients of private practitioners, who are drawn from a class who habitually look after their teeth, make every effort to save them as long as possible and whose diet and mode of life would be expected to add to their general efficiency.

Is there anything in this theory? It is put forward purely as a conjecture and can only be left as such for the experienced research worker to decide.

Though it is realized that the numbers dealt with in this investigation are small, it is hoped that these figures may help towards establishing the wisdom tooth as a really useful member of the human dentition and, still further, be of help to those who are investigating the causes and prevention of impacted third molars.

In conclusion, I would like to express my thanks to Major-General H. C. R. Hime, C.B., D.S.O., M.B., K.H.P., who instigated the investigation on which this paper is founded and gave me very great encouragement, and to the officers of The Army Dental Corps in the Southern Command who so willingly did all the work.

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THE DOCTOR'S WAR, 1899-1902.

By D.A.D.M.S.

(*Continued from p.* 28.)

The situation now hinged on where the Boers would make their next stand and everything pointed to the Modder River. Information reported both the Modder and Riet Rivers in flood, and that Remington's Scouts, an irregular Corps of Mounted Infantry, who wore a picturesque headgear of soft slouch hat with a band of spotted skin, so-called Remington's Tigers, also reported that the Boers were strongly entrenched on the *South* bank of the River. This latter bit of information was heatedly discussed after the battle as the truth, or otherwise, of such a report was of the utmost importance. The advance on November 28 was like this. The screen of mounted patrols moved off at first streak of dawn about 5 a.m., the transport inspanned, and the infantry, in long serpentine lines, started out over the parched veldt. The wagons follow four abreast spread out over the plain, with their escort marching on each side. Not much notice is taken of the so-called road, which is just a track on the hard-baked ground. Away out in front is Modder River, and on the right the Riet River, where it branches off from the parent stream. In the centre of the position would be the railway bridge, sure to be destroyed, and the ford, or drift, below the bridge reported impassable from the flooded condition of the river. We have to reach water, we have to get to Kimberley, we have to push on, we cannot sit down on a barren waterless plain and wait for a flooded river to subside. So the British Army marched grimly on to meet the foe they had twice defeated in that same week. The supplies and ammunition came puffing along behind on the rails. The Ambulance Train followed on. Rather an odd sort of war it now seems, marching straight on up the line from one station to the next, not knowing at what station Brother Boer would refuse to clip our tickets and let us through to Kimberley! So we plodded slowly on, and presently the sun rose and blazed down on us, and it was very hot. Then firing began. All the troops were now in extended order, and we could see line after line disappearing over our immediate horizon of heat and haze. So we halted and waited. The firing rose to a crescendo of rolls of musketry and would die away again. We saw shells bursting and heard guns firing, but that was nothing, it was the sustained rifle fire that seemed to go on and on. All that hot day we waited. No orders came to unpack and open up our Field Hospital. At times we heard something like a giant machine gun. It sounded pom-pom-pom-pom. We learned later, by experience, it was a quick-firer, pouring out a stream of one-pound shells, and very effective, not to say nerve-racking. Somebody wrote about it under the name of "A Ballade of Ten-a-penny."

"'POM-POM-POM'—and the shells have flown;
'BANG-BANG-BANG'—without rise or sink—
Accurate sameness to half a tone—
Whizzing one-pounders—don't stop to think,
Open the ranks like a 'speilers' wink.
This is a speedy and frolicsome bomb,
Do not despise it, but do not shrink.
This is a nerve test, this swift pom-pom."

Our O.C. rode forward to find out what he could. He came back somewhat gloomy and told us we seemed to be held up. The Boers were firmly entrenched, and our infantry came under a withering fire as they approached the thin line of low bushes fringing the river. There was absolutely no cover; nothing on that bare expanse of veldt but the scattered ant-bear heaps, smooth, round excrescences dotting the plain. White marks on these heaps showing towards the river taught us that the enemy had carefully marked off the ranges and had only to wait for each successive wave of men to come to the marked area to have the exact range. Our men could do nothing but lie down and scoop up what little protection they could. Some time during the afternoon part of the Highland Brigade arrived and pushed forward. They met the same fate and had to halt and lie flat. Hence the fact that many of them became casualties from getting the tender-skinned back of the knees burned by the sun as they lay prone. Somewhere on the left our Naval 4.7 guns were firing lyddite shell at the Boer positions across the river. One could see the big black burst of the shell. I believe this stuff produced very acrid yellow fumes which stained the skin, and made people feel sick. The Boers were said to carry bottles of vinegar to inhale and rub on the skin, but I cannot vouch for this. I never saw any Boer wounded stained yellow, and I rather imagine the effect of the shell was much the same as the high-explosive in the Great War. At one time in the afternoon our Field Hospital was moved back as shells were bursting fairly closely. Towards the end of the day we received orders to open up, and wounded commenced to trickle in. I remember seeing Lord Methuen being brought in wounded, he had been shot through the fleshy part of the thigh and had a narrow escape. As it was he refused any question of evacuation, and was only a few hours or days in hospital. It soon became evident that we were held up and the battle seemed to settle down to a stalemate. But unknown to us at the time, some of our infantry had forced a way over the Modder and gained a holding on the northern bank. At any rate, the enemy did as the Arab. After the cares that had certainly infested the day of battle, he waited until night fell, and then silently stole away. When dawn broke the Modder was in our possession, and another fence on the way to Kimberley was down. Four officers were killed and nineteen wounded at the Modder fight. Amongst the wounded was Captain Guise-Moores, of the R.A.M.C. Lord Methuen in his dispatch said, "Again I call attention to the splendid hospital arrangements, for at

4.45 p.m. on the day after the fight, all my wounded were on the way to Cape Town. I am glad to have been slightly wounded, because in no other way could I have learnt the care taken of the wounded; and there was nothing officer or soldier required that was not provided at once, and the Medical Officers never tired in their endeavours to alleviate suffering." It was the fashion of the time to express feelings in poetry, and in the *Morning Post* the following lines appeared after, if perhaps a long way after, the Kipling style:—

> " But here's to the man of the R.A.M.C.,
> Buzzing about on the field like a bee,
> Tending the wounded where lead's flying hot,
> Biting his lip when he gets himself shot;
> Brave as the best of us, hurt and not tell,
> Doctor he may be—he's soldier as well."

After this strenuous week of battles, Belmont, Graspan and Modder River, we settled down for a general tidy up and re-fit. We pitched our field hospital on a site over the river and not very far from the hub of life, i.e. the local hotel, which rapidly became the sort of central club and gathering place in the late afternoons. Here one heard all the chat and rumours, all highly coloured and thoroughly unreliable. One of the japes was that Cecil Rhodes was sending helio messages from Kimberley to ask if we were building stone houses or huts at the Modder. Any cloudy evening the searchlight from Kimberley was dot-dashing in the sky, and we were replying. Between us, at Magersfontein, the next fence to be jumped, sat General Kronje and his Boer Army. He also joined in the game of playing his searchlight in the sky to confuse the messages. Our Naval guns had moved up and were plugging lyddite shell at that long low range of hills where Kronje sat. It was part of the day's excitement to go up to the gun positions, where cheery and obliging Naval officers would let you look through their fixed telescopes and watch the enemy's trenches stretching along the bottom of the kopje. One could plainly see Burghers moving about on the hillside, but at the bang of our 4·7's all would go to ground like rabbits. Then a pause, and a puff of smoke on that distant hill; and a shell would come over in our direction. But the firing was desultory on both sides and little damage was done. So we waited, and both sides strengthened themselves for the next struggle. But it was not for long. On the night of December 10 we moved off with the transport. It was a bad night, dark as pitch with rolls of thunder and heavy rain. We went very slowly and I sat and dozed on my pony, got off and walked, and just kept awake. Our Transport N.C.O. rode a white horse, and once as he passed me I saw him miraculously vanish from sight and his white pony pass on into the darkness. I also heard language. Groping my way towards his direction, I found him seated on the ground and cussing all sappers who had plucked him from his seat with a field telegraph wire stretched from invisible poles.

When the blue of night merges into the grey of day, and just before the dawn, a hellish burst of fire tore the night apart. It was sustained, severe rifle fire and it went on for some time, half an hour perhaps, then it eased down to a steady, even sort of noise, with an occasional sharp spurt. Not a sound of a gun, all rifle or machine-gun fire. Then it all ceased. We moved on. The rain was over. It was the bright early morning of the South African veldt. The air pure and clear and exhilarating. I suddenly saw a soldier seated on a small ant-hill some short distance away. I got on my pony and rode over to him. He was a young soldier, not a reservist, of the Highland Brigade. He had no helmet, no rifle and no equipment. I asked him what he was doing there and where was his battalion. He looked at me in a dazed sort of way and said, in a strong Scotch accent: "All the battalion is wiped out, and all the officers is killed." I led him back to the wagons and gave him a lift. As we moved forward we saw more men sitting about, and one got the same story of some sudden disaster to the Highland Brigade. It was now quite clear, and one could see the line of kopjes in front. Now they looked quiet and perfectly silent. Wounded Highlanders were being collected and we rapidly organized a dressing station, preparing plenty of hot bovril for the exhausted men. Also parties of men under an officer would turn up looking for drinking water, and our water cart was kept busy supplying them. I went forward with a stretcher party as it was obvious the Bearer Company had much more work than they could cope with. We worked right up towards the kopjes and eventually reached a wire fence where dead soldiers were hanging. Many wounded were scattered about. Quite suddenly we came on a group of dead civilians, as they seemed to us, big men dressed in plain clothes but most of them wearing long field boots. One was still alive and we picked him up. They were Scandinavians who formed a special contingent of the Boer Army. It was said they had joined Kronje the night before and had been detailed to act as an advance patrol or listening post. Anyhow, they had struck the Highland Brigade somehow and had been wiped out. We were told an armistice had been arranged to allow us to collect our dead and wounded. I know that the silence was suddenly broken by our Naval guns opening up, and there was some suspense lest the Boers would open fire on our collecting parties, which they were perfectly justified in doing. Some error had been made in not getting a message through to the guns back at Modder; it was soon rectified, and the Boers made no sign. I was close enough up to see the Boer trenches winding along at the base of the kopjes, or rather well in front of the rocky background. This was obviously a better place for their first line of defence, as our guns hitting the rocky outcrops broke them up and scattered fragments far and wide. But one could also see defences further up the hillside. Once or twice I saw well-dressed Boers, looking like officers, walking about in an unconcerned way. They wore riding breeches and leggings or field boots, ordinary sporting sort of tweed coat, slouch hat, bandolier full of ammunition, and carried

Mauser rifles. They looked like the ordinary sporting type of farmer one might see at home. They did not interfere with us in any way.

It was during this period of armistice that one of our R.A.M.C. officers got himself into some trouble. It was said he rode forward to help in the work, and, having dismounted, left his horse to a groom to look after. One of the young men I have described above had a look at that horse and noticed a revolver butt sticking out of the holster. He asked the groom in good English whose horse it was. The groom pointed to the medical officer and said: "That bloke over there," or words to that effect. The young Boer strolled over to Major B. and started chatting. Presently he pointed to the horse and said: "Nice beast that. Your property?" Major B. said: "Yes, my horse." "Let's have a look at him," suggested the Boer amicably. As they reached the horse the Boer pointed to the revolver and remarked: "That yours also?" Major B. saw the trap he had fallen into and said: "Oh, yes, I carry that for shooting wounded horses or mules." "Well, well," said his captor, "fancy that now, a medical officer with a revolver, and we supposed to be fighting under the Geneva Convention; better come along and see the Commandant." The story goes that Major B. was handed over to some German doctors who took him round their field hospital and put him through an unofficial medical examination. They evidently reported he was a medical man and he was safely returned some days later. I wonder what would have happened to him in the Great War under similar circumstances?

When we had picked up all the wounded we could see we made our way back to our Dressing Station. We found it busy and somewhat embarrassed by the continual arrival of slightly wounded or merely sympathetic soldiers who were helping in the good work. The history of the early morning attack was constantly repeated. It is told in a few words.

The Highland Brigade was advancing in quarter column just as dawn was breaking. The line of hills loomed up in front and the order was given to extend when the whole base of the hill lit up with the flashes of a hurricane rifle fire poured into that dense mass of men at close range. A story was told of lamps on the flank of the attack being flashed as a warning to the enemy. The shock to the Brigade was immense. Men fell in swaths. One bullet may easily have stopped several men, fired into the brown like that. It was said there were confused calls of "Advance" and "Retire." Some tried to get forward, some were forced back, and the bullets lashed on them like hail. The attack had failed. The Brigade Commander, General Wauchope, was killed. Later in the day a second attempt was made to attack the enemy position, but it was also held up, and it was not a very strong attempt. The Boer guns began to get active and it was decided to move back to our camp (which had been left standing) at the Modder River. Slowly we moved away, not hurrying in the least, though the Boer shells were falling thicker now. It was strangely

like a wounded animal turning his back on his enemy to lick his wounds and rest himself for the next fight. It was a sullen menacing retirement. I wonder what the Boer thought as they watched us. At any rate they made no attempt to follow us. I expect old Kronje had his coffee and telegraphed to President Kruger at Pretoria to say, "The war is over. Englishmen beaten and on their way back to Cape Town to their ships." But we only went back to the Modder River, carrying our wounded—and dead—with us. Next day was the saddest I can remember of the whole war. All day the Highland Brigade buried their dead. General Wauchope was laid to rest by the men of the Black Watch. Two large graves running North and South, gave resting-place to the men of the Brigade, and at right angles to them rested many of their officers. Chaplain Robertson laid officers and men to rest with the simplicity of a Presbyterian graveside service, and then the mournful strains of the pipes in "Lochaber no more." We were back in our tented Field Hospital once more.

Some very interesting things were written in the Home papers after the battle of Magersfontein. Under the title of "The Moral of this War," Julian Ralph wrote as follows: "Magersfontein seems likely to be the end of the Chapter of War as practised by the Wellingtons, Wolseleys, Von Moltkes and Grants. Given a plain field, modern magazine rifles, and quick-firing small guns, the whole German Army could not dislodge the entrenched 65,000 men of the Boer Republics. If Germany got in a trench that could not be turned, all the world could advance and be slaughtered, but not all the world could oust the Germans from that trench." Somewhat prophetic words written at the Modder River at the end of 1899.

I would like to hark back to the evening of that December 11. I had returned with my stretcher party to the Field Hospital. Weary but excited at having been under fire for the first time I was met by the sergeant-major, who eagerly informed me that a staff officer wearing kilts had visited the hospital and asked for the name of the officer of the unit he had seen collecting wounded under fire. I asked was he sure he was a staff officer. "Oh, certain, sir, of course they don't wear distinctive dress now, but he was dressed in a Highlander's uniform and spoke as if he was on Lord Methuen's staff." I was greatly bucked at this, and had already seen my name in despatches for a D.S.O., when the sergeant-major came running up again. "Here he comes again, sir." I dashed out of the tent to meet this important person—and saw a certain M.O. of one of the battalions in the Highland Brigade who affected the wearing of the uniform of the battalion instead of R.A.M.C. kit, and was greeted with a request for cigarettes and nourishment. I was delighted to see him and gave him both.

The Army settled down again at the Modder. The Divisional Field Hospital soon began to fill up. Many cases of a sort of colitis occurred, said to be due to the heat, dust and sandy grit in the drinking water, and nick-named "The Modders." I do not think we had any clarifying

plant in those days, I mean on a big scale, though many of us used Berkefeld filters, and I know the candles were brown with dust after a few pumpings. Our gallant O.C. spent much time in a very hot tent developing photographs from his cinema-camera. He got some excellent photos of long spans of oxen dragging naval 4.7 guns into position for shelling Magersfontein.

We settled down to a life of routine. I remember a sort of reconnaissance in force towards the Boer position which stirred up the somnolent hills and drew pretty smart fire, showing us that brother Boer was still there. Our opposite numbers, the Bearer Company, sat down near us and occupied themselves in collecting sick and bringing them to us. Having done that they rested for the day. As we got busy they still rested. Their job was to collect wounded under fire and, at a pinch, sick people when actual fighting was not going on. I do not know how long this absurd system remained in force as I left the hospital to become medical officer to a mounted infantry unit, the 2nd Mounted Infantry, and that begins a new story of movement and fighting, and various adventures.

A TOUR OF THE BATTLEFIELDS IN FRANCE.

By Colonel A. N. FRASER, D.S.O.,
Royal Army Medical Corps.

Under the direction of Major-General J. A. Hartigan, C.B., C.M.G., D.S.O., K.H.P., Deputy Director of Medical Services, Aldershot Command (now Director-General, Army Medical Services), a most successful Tour of the Battlefields was arranged for Royal Army Medical Corps officers from Aldershot.

In the past, tours of the battlefields have been confined to officers of the combatant branches of the Services, and now that Aldershot has had a tour for R.A.M.C. officers only, it is hoped that other Commands will follow the excellent precedent thus established.

The Directing Staff consisted of Major-General Hartigan, Deputy Director of Medical Services, Aldershot Command; Colonel J. P. B. Robinson, C.M.G., D.S.O., Assistant Quartermaster-General, Aldershot Command; Lieutenant-Colonel A. E. Stokes-Roberts, O.B.E., M.C., General Staff Officer, 2nd Grade, Aldershot Command; and Lieutenant-Colonel A. N. Fraser, D.S.O., R.A.M.C., Assistant Director of Hygiene, Aldershot Command.

The preliminary arrangements for transport, hotel accommodation and passes were in the hands of Lieutenant-Colonel Stokes-Roberts.

The officers detailed for the tour (eleven in number) were selected from officers who had not served in the forward areas in France during the Great War, and they were instructed to study Chapters II, IV, XI and XIV of the Official History of the War, Medical Services, vol. iii.

Maps were issued three weeks prior to departure for France, and two conferences were arranged for the purpose of explaining the objects of the tour, and marking on the maps the lines held by the British at the Battle of the Somme, July 1, 1916, the battle of Arras, April 9, 1917, the battle of Cambrai, November 20, 1917, and the line on March 21, 1918, prior to the retreat. The positions of casualty clearing stations, stationary hospitals, motor ambulance convoys and main dressing stations were also marked on the maps. The D.D.M.S. explained the general scheme of evacuation in each phase of the campaign, Colonel Robinson gave a very lucid explanation of the "Q" work, and Lieutenant-Colonel Stokes-Roberts discussed the "G" point of view.

The whole idea of the preliminary study of the Medical History of the War, and of the conferences in Aldershot, was to ensure that all attending the exercise had a general knowledge of the phases of the campaign which were being specially dealt with, to reduce to a minimum set lectures in France, and thereby leave the maximum time for discussion on the actual ground.

The party left Aldershot at 6.15 a.m. on Sunday, July 23, 1933, by

char-a-banc for Victoria, thence to Folkestone and Boulogne, where we lunched before our departure by char-a-banc for Arras, our headquarters during the tour.

On the road to Arras we passed through Etaples, Montreuil, Hesdin, St. Pol, Aubigny, Hautes Avesnes and Agnez les Duisans, and from St. Pol onwards the D.D.M.S. explained the medical situation and arrangements for the battle of Arras, and pointed out the sites of the casualty clearing stations and main dressing stations.

On Monday, July 24, the original intention was to "do" the battle of Arras and visit the caves; as a preliminary to this, Lieutenant-Colonel Stokes-Roberts explained the preparations carried out prior to the attack and Colonel Robinson went into the question of refilling points, supply of ammunition and transport arrangements. Unfortunately the visit to the caves could not take place at the original hour arranged and the D.D.M.S. decided to visit the Somme area, and study the battle of the Somme, 1916.

We left via Ronville where an Advanced Dressing Station was established for the Arras battle, and travelling south, close to Ficheaux, we passed Boiry St. Rectrude, where in the later stages of the battle of Arras the VIIth Corps had a main dressing station, thence through Ayette, where Colonel Robinson was in the final offensive of 1918, to Pusieux au Mont and Serre reminiscent of most fierce fighting, which was graphically described by Lieutenant-Colonel Stokes-Roberts before going on through Auchonvillers to Newfoundland Farm, almost due north of Hamel.

At this point, where the war memorials of the Newfoundland Brigade and the 51st Division overlook Beaumont Hamel, we were given an account of the battle, with special reference to the 29th Division, and were reminded of the fact that during this period tanks made their first appearance at Flers.

Major-General Hartigan explained the medical arrangements, pointing out the difficulty in disposing of the very large number of casualties incurred on the first day of the battle of the Somme.

We then visited the trenches, which have been preserved, in Newfoundland Farm, in the vicinity of Y ravine and after lunch at Hamel visited Thiepval War Memorial.

In the afternoon we studied in more detail the medical arrangements of the XIIIth Corps which occupied the right of the British line at the battle of the Somme, following the route of the wounded man from the front line to the Casualty Clearing Station. We visited Fricourt, Mametz, Montauban, Boufay Farm, Bray sur Somme, Dives Copse to Corbie and La Neuville where the casualty clearing stations were located.

We returned to Arras through the back areas via Querrieu, where General Rawlinson's 4th Army Headquarters were located, Villers Bocage and Beauval, site of a casualty clearing station, thence to Doullens, leaving on our left Gezincourt, where there were two casualty clearing stations.

Passing through Doullens, where in the Citadel there was a casualty clearing station, we saw the unpretentious hostelry, Le Quatres Filles, where the momentous decision was made that Marshal Foch would be Generalissimo of the Allied Forces. Our road from this point to Arras took us through Mondecourt, the headquarters of a motor ambulance convoy, Warlincourte Halte, where there were two casualty clearing stations on the south of the road and one in a chateau on the north side of the road to which the wounded of the Left Corps in the battle of the Somme and the Right Corps in the battle of Arras were evacuated, and Larbret where, for a short time during the Arras battle, there was a main dressing station.

On Tuesday, July 25, the D.D.M.S. described the medical arrangements for the battle of Arras and paid tribute to the D.M.S. 3rd Army, Major-General Sir Murray Irwin. Lieutenant-Colonel Stokes-Roberts told us of the preparations for the battle, the weather conditions, the preliminary cutting of wire by intensive artillery bombardment and of the tunnelling and mining operations.

We then proceeded to Monchy le Preux, halting on the way at Tilloy to have the earlier phase of the Arras battle explained, and here the D.D.M.S. went more fully into the medical arrangements of the VIth Corps and by his description of a gas attack emphasized the importance of gas discipline.

From Monchy we went to Roeux where a most interesting description was given by the D.D.M.S. of the evacuation by rail, canal and road to St. Nicholas and Haute Avesnes. Gavrelle, the furthest point reached in the battle of Arras, was then visited and we returned to Arras via Thelus and Vimy Ridge.

A visit to the famous Arras Caves followed and in these underground vaults we saw how the Divisions had been housed prior to the attack; similar caves housed the well-known Advanced Dressing Station for the VIth Corps. Apart from the original caves, formed by the removal of stone for the building of Arras, one saw communicating galleries constructed by tunnelling companies, remains of the extensive electric lighting and the sanitary arrangements.

In the evening the majority of the party visited, under private arrangements, the Canadian War Memorial and the trenches which have been maintained by the Canadians at Vimy Ridge. This visit was of great value as the dug-outs have been well preserved and gave one a very good conception of a trench system.

On Wednesday, July 26, at the usual early morning conference, a trench map was shown and explained, after which the events leading up to the battle of Cambrai were dealt with by Lieutenant-Colonel Stoke-Roberts.

As is well known, the secret of the attack at Cambrai was very carefully kept, including the very difficult concentration of tanks at Havrincourt. This attack differed from others in that there was no preliminary artillery bombardment and we depended on the tanks to flatten out the German wire.

The extensive preliminary training carried out by the tanks co-operating with Infantry was fully dealt with. The D.D.M.S. then explained the secret of the preliminary medical arrangements and with what care these had to be carried out in case those not aware of the impending battle should become cognisant of the state of affairs. After describing from a medical aspect the battle of Cambrai, Major-General Hartigan gave a most interesting talk on the final German offensive in 1918 with special reference to the 19th Division (3rd Army).

Whilst we can read of this offensive and our retreat in the various official histories, nothing impresses itself so much on one's brain as a word picture by an eye witness given on the actual ground, and the lessons learnt from the retreat as described to us will remain much more clearly than if we had read innumerable textbooks.

After the conference we proceeded to Flesquieres via Bapaume, Ruyalcourt—M.D.S., Ytres—C.C.S. group, Neuville, and Ribecourt. At Flesquieres, Lieutenant-Colonel Stokes-Roberts dealt with the Cambrai battle and by a series of map tracings made each stage in the fighting very easily understood.

Unfortunately visibility on this day was poor and as the crops had not been cut it was difficult to pick up landmarks. Even the position of the Hindenburg Line could not be identified with certainty.

After lunch at Flesquieres the return journey followed the line of the retreat of the 19th Division, halting first at Doignies where with one of the trench maps actually used during the attacks the two attempts to recapture that village were discussed.

We then passed through Bapaume, Grevillers, Irles, Achiet le Petit, Bucquoy and Ayette and so to our Headquarters, the Hotel de l'Univers, Arras.

Thursday, July 27, meant an early start as, by the courtesy of our Director, instead of returning direct to Calais we were taken north past Vimy Ridge, Lens, Loos, Neuve Chapelle and Armentières. At Messines Colonel Robinson described the capture of the Ridge in 1917. Next we visited Ypres and after passing through the Menin Gate the D.D.M.S. at the Hooge Chateau gave a brief description of the days spent in the Ypres Salient. Vlamertinghe, Poperinghe, Remy Siding and St. Omer lay on our road to Calais and so to Dover, the tour over.

Glorious weather and a calm sea favoured us and what at one time seemed a formidable task was completed without any untoward incident.

The tour was not only a great pleasure to all taking part but was most valuable from the lessons learnt. It is to be hoped that, though this was the first tour of its kind for Royal Army Medical Corps officers, it will by no means be the last.

THE CONTROL OF SCHISTOSOMIASIS IN SOUTH AFRICA.

By F. G. CAWSTON, M.D.Cantab.

When, in 1916 and 1917, I was serving in the South-African Medical Corps at Potchefstroom and Roberts's Heights, it was customary to supplement the quinine treatment for malaria with intramuscular injections of some arsenical preparations, intravenous injections being entrusted to officers who had gained a special knowledge of the subject.

I was fortunate in being able to follow Captain Wheat's method of administering intramuscular injections of vaccines; but of intravenous injections I had had no personal experience and, at that time, they were rightly regarded as necessitating special skill. Much trouble might have been avoided in recent years if this fact had been readily acknowledged.

When antimonium potassium tartrate was introduced for intravenous administration, attempts were made to apply it for the possible destruction of malaria parasites; though the drug is indicated rather for its action on large parasitic worms and for certain skin conditions.

Unfortunately, the supply of the drug which was then available was not sufficiently purified for intravenous work, and sterilization by boiling would not remove such impurities as lead, which were responsible for toxic results. The toxic effects were sometimes attributed to a too concentrated solution, sometimes to the use of too large quantities of distilled water. Careful analysis of the drug itself, however, revealed the presence of undesirable constituents and more careful efforts to produce a reliable supply resulted in the disappearance of toxic effects from skilfully applied therapeutic doses.

The unfortunate experience of the past, however, could not easily be forgotten and the prejudice of the profession in the home country against the employment of tartar emetic in solution was well reflected in an address given by the late Professor W. E. Dixon at the Congress of the British Association for the Advancement of Science held at Capetown.

Military officers who had had a similar experience with the drug under active service conditions likewise hesitated to be responsible for a recurrence of the untoward results of what should be a harmless form of treatment and, when the British Drug Houses made available a large supply of the sodium salt, either in tablet form or supplied conveniently in ampoules, on the assumption that it would be less toxic than the potassium salt because sodium salts have been held to be less toxic than the potassium for oral administration, antimonium potassium tartrate fell into disuse and, in spite of the fact that soloids and other tablets of the potassium salt were demonstrated to be entirely free from undesirable toxic effects, they became difficult to obtain.

At official institutions in South Africa, bilharzia infection was treated

either by the sodium salt or by fouadin, its sodium equivalent; though both antimonium potassium tartrate and antimosan, its potassium equivalent, still held their deserved place at the Institute for Veterinary Research at Onderstepoort.

In view of the absence of evidence as to the complete destruction of both male and female parasites in a large proportion of cases treated for Bilharzia disease and the possibility that these persons may not only be innocently spreading the disease to new localities but are themselves harbouring septic foci for the fostering of carcinomatous growths, it would seem that the treatment of Bilharzia disease should be confined to persons who are able to administer the potassium salt intravenously without producing undesirable local or general disorder. Where this is impossible, intramuscular injections of antimosan or possibly fouadin should be given carefully over a period of six weeks, and that they should be immediately replaced by intravenous injections of tartar emetic should toxic effects be experienced, rather than that attempts should be made at spectacular and rapid "cures."

The question had been raised whether different races and different localities may give rise to contrary experiences with a drug such as antimony. I had under treatment in February a case of *Schistosoma hæmatobium* infection who tolerated the usual doses of the potassium salt dissolved fresh before each injection, and up to 1¾ grains without the slightest toxic effects. At the end of eight days he was obliged to return to his work in the Transvaal and I sent his medical officer a supply of the tablets I had been using. Though the same precautions were used with the subsequent injections, at an altitude of 4,436 feet above sea-level he experienced pain in the shoulders for about twenty-hours after each injection. I had always regarded these pains as due to impurities in the drug. The opportunity occurred for me to be away from Durban for a fortnight, so I took occasion to see his medical officer and confirm the fact that the injections were given as I had given them. Furthermore, I visited the waterworks and ascertained that the town supply was treated with chlorine. Destruction of the parasites may help to explain these muscular pains which were the only toxic effects that troubled this patient, but environment has to be taken seriously into account in the possible explanation of toxic effects due to drugs.

In view of my own exposure to infection whilst investigating possibly infected pools during my absence, and in consideration of an obscure eosinophilia, on my return I gave myself a course of intravenous injections of the potassium salt and found that, whilst my general health and appetite improved forthwith, there was definite pain in the left shoulder after an injection of 1½ grains given into the vein of the right arm.

Whilst in the Transvaal I called on the Chief Medical Officer of Schools who has carefully watched the effect of fouadin and the sodium salt on school children collected for treatment at special camps, and he invited me

to visit the Fountainbloem school where Bilharzia infection had broken out among the scholars. Some of them had never left this locality, which is just outside the municipal boundary of Johannesburg at an altitude of about 6,000 feet; the infection had been acquired through bathing in the little Yokeskei River which drains into the Little Crocodile, a badly infected river.

I found *S. hæmatobium* in the urine and collected *Bullinus forskalii* from the favourite bathing pool of the children. This is a carrier of the infection at the Natal coast. I did not have time at my disposal to search higher upstream for overflow pools which presumably would contain *Physopsis africana* and its favourite food supply, the light-blue water-lily; but during my investigations I found that *Nymphæa stellata* had been carefully transplanted from Isotsha, an infected area near Port Shepstone, Natal, and introduced into a locality in the Transvaal which is extraordinarily free from the snail hosts. Though the water plant is protected by Government, apparently because of its beauty, this experience indicated one way in which the disease may be introduced into new localities.

In dealing with an outbreak of Bilharzia disease amongst the poorer class of patient, it will not be sufficient to employ a remedy which will merely remove the obvious signs of the disease. Every effort must be made to destroy both male and female parasites, and this may well be done by skilfully administered intravenous injections of tartar emetic, given by approved physicians. Cystoscopic examination of the bladder and microscopic examination of the urine reveal little evidence of the death of the male parasitic worms.

There is no authority in the Union of South Africa which concerns itself at the present time with the control of *P. africana* Krauss, the usual disseminator of Bilharzia infections of both the common kinds, even though the outbreaks of schistosomiasis in stock at Humansdorp in the Cape and Vryheid in Natal showed that the sheep and cattle parasite might prove of widespread economic importance, and that the disease among school children in certain districts is responsible for much inefficiency and ill-health.

Since Dr. Annie Porter left the Union, much of the study of trematode infection from the human point of view has been at a standstill.

It is suggested that as the distribution of the snail-host largely corresponds with that of anopheles, where malaria infection is being controlled similar methods of destruction of the snail might be undertaken as are applied for mosquito destruction.

Whilst appreciating to the full the value of teaching methods of disease prevention to school children, it would be difficult to over-emphasize the importance of the instruction in hygiene which is given at Roberts's Heights by Captain E. Baber and his subordinates to the Special Service Battalion.

Editorial.

THE NUTRITION QUESTION.

PUBLIC interest in diet questions may be said to date from the Great War period, when, owing to the rationing of food, everyone had a personal interest in the provision of sufficient food for the family.

The economic depression has again focused attention upon diet and nutrition, and there has been considerable anxiety as to whether the unemployed and the poorly-paid workers have sufficient purchasing power to secure adequate food for themselves and their families. Divergent opinions on this matter have appeared in the Press.

The inquiries made for the Ministry of Health, outlined in Sir G. Newman's Report for 1932, sought in the mortality returns for any evidence on this subject. Towns with high unemployment, when compared with those having a low incidence, did not reveal any disadvantage on the side of the "bad" towns. Evidence of malnutrition was also sought for in the reports of Medical Officers of Health and School Medical Officers. In 1918, school inspection showed evidence of malnutrition amongst 12 to 15 per cent of the children. Since then the figure for malnutrition for the whole country has fallen to about 1 per cent; it was 1·07 per cent in 1932.

The height and weight of school children have definitely improved in the last ten years. Reports from London, Lancashire and Liverpool are couched in the same vein. Most of the evidence concerns child life which, if not protected, quickly responds to an unfavourable environment.

Information as to the condition of the population above 16 years of age obtained from the National Insurance Scheme did not furnish any evidence of excessive sickness among insured persons attributable to unemployment.

Taking the country as a whole, Sir George Newman stated that, except in certain localized areas and in some special and restricted groups, there had been no general excess of sickness, ill-health or physical incapacity attributable to unemployment. He, however, pointed out that while the reports contain no evidence of widespread physical degeneration, there is an undercurrent of fore-warning as to the consequences of prolonged under-nourishment of women and children.

Before any attempt can be made to define the constituents of a diet adequate to maintain a family in health, it is necessary to agree upon the amount of food required by the average working man and the proportions of this which should be allotted to the members of the family of varying ages.

In an investigation of family diets carried out for the Medical Research Council at St. Andrews Professor Cathcart employed a scale for determining the man-value of the various members of a family. He combined the values

given by Atwater and Lusk, and adopted the following figures: man, 1·00; woman, 0·83; boy 14, 1·00; girl 14, 0·83; child 12 to 14, 0·90; child 10 to 12, 0·80; child 8 to 10, 0·70; child 6 to 8, 0·60; child 3 to 6, 0·50; child 2 to 3, 0·40; child 1 to 2, 0·30; child 0 to 1, 0·20.

Varying figures have been given for the calories required by an adult man of average stature. Cathcart's studies of working-class populations would seem more relevant to present economic conditions than the estimations made by German and American scientists. The families which Cathcart investigated at St. Andrews included both rich and poor, but in later investigations at Reading and Cardiff he studied the diets of working-class families. Employing the man-value scale used at St. Andrews, Cathcart and Murray found the diet per man per day at Cardiff yielded 3,174 calories and at Reading 2,906 calories. They considered these values to be comparable to the Glasgow artisan class, who obtain a diet containing 3,070 calories. Studies of unemployed families showed that much depended on the amount of the income spent on food and on improvidence of one or both parents, or general incapacity. The Cardiff families spent 77 per cent of their income on food and the Reading families 58 per cent.

A special study was made of the diets of families who according to the current man-value calculation obtained 2,500 calories and under per man. The mean value of eight Cardiff families was 2,380 calories; nearly 800 calories below the general mean for Cardiff. In Reading the mean value for twelve families was 2,193. The worst Reading diet had an energy value of only 1,708 calories.

As regards the influence of parental capacity on diets there was a curious difference between the inhabitants of Cardiff and Reading. The good mothers in the former town expended 54 per cent of the total income on food and the bad mothers nearly 70 per cent, whereas in the latter town the good mothers expended 58 per cent of the total income on food, the bad mothers only 45 per cent of the income on food.

Cathcart asked the question "How, if food be the material which makes good the wear and tear and supplies the energy for the performance of work, can this necessary repair substance and energy be obtained from intakes of 2,500 calories and less, assuming the recipients are healthy?" But his previous work on the diets of families in St. Andrews suggested that the wage-earner is never reduced to this level. Those who suffer are the wife and possibly the children.

The question naturally arose as to the adequacy from a general health point of view of these diets. Objective examination of the various members of the different families did not suggest any serious malnutrition. If malnutrition had existed the children should have shown some degree of under-feeding. But the Cardiff and Reading children were found to compare very favourably with the average body of English school children.

Influenced, probably, by Cathcart's work, the Advisory Committee on Nutrition to the Minister of Health issued a Memorandum on the criticism

and improvement of diets. They stated that the diet in question might be the diet of an individual or, as is more likely, it might be the diet of a group of people such as those in an institution, a home for children, etc. The same considerations were said to apply to both. In their Memorandum the Committee recommended that the calories per man per day should total 3,000, or thereabouts, and where the total calorie intake is divided by the total "man value" (calculated on Cathcart's scale), that is the figure which should be reached. Any deficit greater than ten per cent should be viewed with suspicion—in the first place, because the figures chosen as standards are not very generous, and, in the second place, because no account has been taken of wastage.

The distribution of calories between protein, fat and carbohydrate should be in the neighbourhood of 100 grammes protein, 100 grammes fat, and 400 grammes carbohydrate per day. Departures from these figures are considered not to be incompatible with adequate nutrition. If the absolute amounts of protein and fat fall much below 80 and 50 grammes respectively per day, or the percentage of calories derived from carbohydrates rises much above 66, the diet is considered to be in need of improvement.

The Advisory Committee of the Ministry attributed much importance to first-class protein or protein of high biological value. This (for practical dietetics) is to be found only in the animal protein, such as that in cheese, eggs, fish, meat and milk.

The Committee suggested that the absolute amount of first-class protein should be 37 grammes and the percentage content of the total calories should be 5. Five per cent of 3,000 calories is 150, and the calories yielded by 37 grammes of protein are 151·7 or a little over 5 per cent of 3,000.

Most middle-class diets are stated to have about 55 grammes first-class protein, or, in other words, about 7·5 per cent of the total calories is supplied by first-class protein. Working-class diets frequently fall below the standard. Any deficit of first-class protein is thought to be detrimental, for the figure adopted as a standard is not high.

Mineral matter and vitamins are the remaining criteria considered by the Committee. There are as yet no quantitative data of the amounts of the different vitamins essential to the human diet, but fortunately the foods which are useful in supplying mineral matter are also useful in supplying vitamins. The Committee speaks of these foods as "protective foods," i.e. foods which protect the body from deficiency diseases. These protective foods are: milk; vegetables and fruits; liver (including fish liver and fish (cod) liver oil); fish, especially the fat fish and fish roes; and carrots, because of their high carotene content.

The use of these foods practically covers the demands of the body for mineral matter and vitamins.

The Committee emphasize the fact that a diet must satisfy all the criteria. It must stand foursquare upon calories, first-class proteins, mineral matter and vitamins.

Notwithstanding the memorandum prepared by the Advisers to the Ministry of Health, the Council of the British Medical Association, realizing the national importance of nutrition as a factor in the health of the population and probably influenced by the divergent opinions appearing in the Press, set up a special committee on April 12, 1933, with the following terms of reference: "To determine the minimum weekly expenditure on foodstuffs which must be incurred by families of varying size if health and working capacity are to be maintained and to construct specimen diets." In their Report the British Medical Association Committee stated that the absence of a satisfactory standard of "normal nutrition" is probably the explanation why so many divergent opinions are expressed as to the nutritional condition, for example, of elementary school children. It considered that the usually adopted age, height and weight ratios are open to serious objections when applied to individuals. The functional fitness of the individual needs to be studied as well as the anthropometric measurements. The Committee found, as we have already pointed out, that before the family needs could be assessed it was necessary to determine the food intake of a normal adult male. It took objection to the figure of 3,000 calories of food as purchased (suggested by the Advisers to the Ministry of Health) on the grounds that (*a*) it makes no allowance for waste; (*b*) it is not necessarily the optimal quantity; and (*c*) that it is probably lower than the amount the average healthy active man would instinctively take, for many of the data used in its calculation were collected from unskilled, poorly paid and unemployed families during times of industrial depression. A gross supply of 3,000 calories might keep an unemployed man in health, but would not be sufficient for a normal adult male doing moderate work. Taking all the known facts into consideration "the Committee is of opinion that 3,400 calories in the food as purchased is a safe figure for the daily requirements of men of average stature leading a healthy life with moderate muscular exertion. Allowing for wastage in preparation and digestion, this figure of 3,400 calories in food as purchased should assure 3,000 available calories.'

For the determination of the man-value of a family the British Medical Association's Committee adopted Cathcart's scale, and a table is given in their Report. Commencing with the adult male the figures are 1·00, calories 3,400; adult female 0·83, calories 2,840; and so on. The figures they have taken may be open to criticism, but the Committee feels that the words "and maintain working capacity" in the terms of reference justify the adoption of a slightly more generous quantity than a bare subsistence intake.

Dealing with the constituents of a diet, the Committee recommend for an adult male daily 100 grammes of protein, of which 50 grammes should be derived from an animal source, viz., first-class proteins. The minimum quantity of 37 grammes per day of first-class protein is stated to have been calculated upon the protein of milk, which has a high biological value, and it is considered doubtful whether this quantity would be adequate

when supplied by other animal proteins. The Committee point out that the standard ration for Army troops provides 62·7 grammes of first-class protein per day, and is of opinion that a figure somewhere between 37 and 62·7 should be adopted. It agrees that 50 grammes of first-class protein per day is sufficient to maintain the health and working capacity of the average man.

The publication of discordant figures by such important committees naturally led to much correspondence in the daily papers and to adverse criticisms on the figures suggested by the advisers to the Ministry of Health. In view of the importance of the subject and its bearing on the public health, it was felt that arrangements should be made for a joint discussion by the representative physiologists on the two Committees, and in January last a conference was arranged under the chairmanship of Sir Frederick Hopkins, the President of the Royal Society.

After examination of the position, it was at once apparent that the divergencies were more a matter of misunderstanding and misinterpretation than of actual fact. The Committee of the Ministry of Health recommended 3,000 calories and 37 grammes of first-class protein, or thereabouts, as adequate to supply the needs of the average "man" of the *entire* population of the country. The values, being statistical averages, were meant to apply to whole communities and not to individuals, or even single families. No recommendations of an economic nature were put forward.

The British Medical Association's Committee confined its attention to single active families. In coming to its decision, it thought of unemployed men and their families and bore in mind that many unemployed men spend a good deal of time working on allotments, going to and from labour exchanges, and possibly in keeping themselves fit by daily exercises. It, therefore, felt justified in recommending 3,400 calories and 50 grammes of first-class protein per man equivalent as essential to maintain the health and working capacity of a family of this type. The Committee regarded these figures as sufficient to cover a wastage of 10 per cent, but did not suggest that they should be applied to the population as a whole, or even to communities or institutions.

The conference considered it important to emphasize that, owing to individual differences in physique, personal habits, and the variations in the degree of muscular activity involved in different occupations, it is impossible to define any standard of food requirement which can be applied tc all men alike.

The conference thought that a workable solution of the problem of physiologically desirable dietary standards for individuals could only be found in a sliding scale of calorie needs based on age, individual physique, occupation, and habits. In the case of mass calculations of the total food requirements of the population as a whole, where the question of distribution to individuals does not arise, the difficulty of the standard ration being

suitable for individual needs is got over by the give and take in the food demands of the various individuals making up the community.

The conference put forward the following sliding scale of calorie needs for individual men and families of varying composition :—

SLIDING SCALE OF CALORIE REQUIREMENTS PER DAY.

Individuals	Calories, gross
Man : heavy work	3,400-4,000
Man : moderate work	3,000-3,400
Man : light work	2,600-3,000
Woman : active work	2,800-3,000
Woman : housewife	2,600-2,800
Boy : 14-18	3,000-3,400
Girl : 14-18	2,800-3,000
Child : 12-14	2,800-3,000
Child : 8-10	2,000-2,300
Child : 6-8	1,700-2,000
Child : 3-6	1,400-1,700
Child : 2-3	1,100-1,400
Child : 1-2	900-1,000

It was agreed that 3,000 calories would be sufficient for the all-round average requirements of the entire population, or of large mixed groups of people.

The Conference state that the desirable proportion of animal protein to total protein has, so far as their knowledge goes, never been exactly determined; but they are convinced that the growing child and the expectant and nursing mother require relatively large amounts of first-class protein—much more than would be arrived at by simple calculation based on their man-value requirements.

In a diet the proportion of animal protein should not be lower than one-third of the total protein consumed, and may, perhaps, with advantage be increased to one-half.

Clinical and other Notes.

CLINICAL AND PATHOLOGICAL NOTES ON A CASE OF ADENOCARCINOMA OF THE THYROID GLAND.

By Major M. MORRIS

AND

Major R. B. PRICE, D.S.O.

Royal Army Medical Corps.

Cancerous goitres are uncommon even in civil life, amongst serving soldiers they are fortunately quite rare. We invite the attention of readers of the Journal of the Royal Army Medical Corps to this interesting case and the problems which arose regarding its treatment and disposal in view of the fact that the victim was on service in India.

The patient, aged 23, a private in an infantry regiment, with five and a half years' service, reported sick with a history of his neck getting bigger and slight shortness of breath. His attention had been drawn to this by the fact that his tunic collar was getting tight and he was unable to do physical training without becoming breathless. The symptoms had been present for some six weeks before he reported sick. His medical history sheet had no entry for disease or admission to hospital on it. Family history was of interest only in so far as he informed us that "his father died of cancer."

On admission to hospital we found that the patient was a long pasty-looking individual, but well covered. His pulse was 86, temperature normal, urine normal. Nothing abnormal could be found in the cardiac and respiratory systems, except that his pulse rose to 120 after continuous exercise for three minutes, and he became somewhat breathless.

Large abnormal veins were apparent on the chest wall. As regards the central nervous system, there were no signs of tremor; reflexes, deep and superficial, were normal. Nystagmus, eye symptoms, and physical signs associated with Graves' disease were all absent.

The lateral lobes of the thyroid gland were enlarged and appeared soft. There was a hard adenomatous mass the size of a pigeon's egg in the isthmus. This could be moved slightly on the trachea in a vertical direction but not laterally. It was continuous with a hard mass which passed down in a retrosternal direction. Cervical glands were palpable in the supra-clavicular fossa on the left side, they were tender and mobile. The larynx, examined with difficulty, showed the chords mobile and the patient's voice had not changed.

The patient was put on medical treatment for two weeks, and though at first he appeared to improve, his condition changed later for the worse. It was decided now, that as he would not be fit for some time, and extensive operative treatment was required, that he should be invalided home.

About this time the patient commenced to have slight dysphagia and the neck increased from 15 inches in circumference, which it measured on admission, to 17½ inches. He had two urgent attacks of dyspnœa in the night relieved with great difficulty by oxygen inhalations. The voice remained the same and there were no new physical signs. These attacks of dyspnœa became more frequent and all idea of this man travelling had to be abandoned; operative interference was definitely indicated. The advisability of semi-thyroidectomy, cutting the isthmus or complete thyroidectomy was the problem to be faced. Intratracheal anæsthesia was the method of choice, and for this purpose the specialist in anæsthesia Southern Command was asked to visit us and give his opinion. He saw the case and we arranged to operate. The patient passed away early in the induction period of the anæsthetic. The anæsthetist's notes read as follows :—

"Patient was given glucose one ounce four-hourly for twenty-four hours prior to the operation and atropine $\frac{1}{75}$ grain and morphia ¼ grain half an hour before the anæsthetic was commenced. Patient's heart and lungs were examined by me the day before and appeared normal. A mixture of chloroform one part, and ether two parts, was used on an open mask. The induction was difficult owing to the patient struggling and complaining of difficulty in breathing; respiration became worse after about three drachms of the mixture had been given; about a minute later respiration ceased. The anæsthetic was immediately stopped, two intratracheal catheters were passed, pure oxygen was given and artificial respiration was carried out but with no effect. Patient was now pulseless and although adrenalin one cubic centimetre was injected direct into the heart muscle he could not be resuscitated."

A post-mortem examination showed that the thyroid gland was replaced by a mass of neoplastic tissue having no resemblance to normal thyroid tissue. It was stone hard and of a homogeneous white colour. An oval prominence the size of a pigeon's egg occupied the normal situation of the isthmus. It was continuous with and inseparable from a large tumour completely enveloping and compressing the trachea and larynx and extending into and invading the prevertebral tissues.

The tumour was continued downward in a retrosternal direction as a large apron-shaped mass filling the anterior mediastinum as low as the diaphragm and enveloping the pericardium anteriorly. The sternal periosteum, the pleura, and the hilum of the right lung, with the adjacent lymphatic glands, were all invaded. The supraclavicular glands on the left side were also involved.

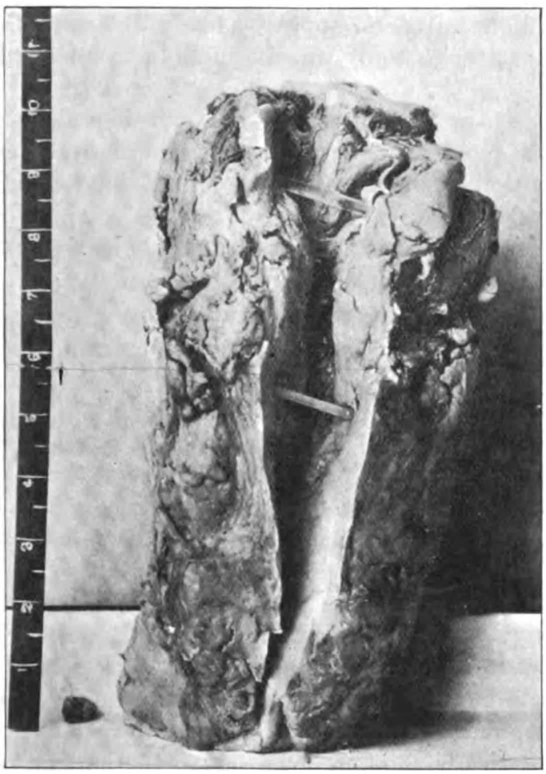
The heart appeared normal and weighed 8¾ ounces. There were about six ounces of free colourless albuminous fluid in the pericardium.

The liver and other viscera were normal.

The thyroid tumour, of which a picture is shown, weighed 4½ pounds.

Sections were taken from the normal situations of the isthmus and the lateral lobes of the thyroid gland and from the lower border of the tumour

near the diaphragm. These sections, microscopically examined, showed dense columns of irregular cuboid epithelioid cells supported by a scanty fibrous stroma containing blood-vessels. The preponderance of the cells over the fibrous stroma suggested a high degree of malignancy. In places the cells were so numerous and irregularly arranged, and the stroma so little in evidence, as almost to suggest a sarcomatous growth. There was no normal thyroid tissue to be seen, but areas were visible where a definite acinous arrangement of the cells suggested the adenomatous origin of the



tumour in thyroid tissue. The cells of the acini were everywhere infiltrating the basal membrane of the epithelium, and appeared in dense columns between the lumina of the acini. The latter contained no colloid material.

The tumour is probably most accurately classified as an adenocarcinoma of the thyroid gland.

Sections from a lymphatic gland in the supraclavicular region showed the gland to be heavily infiltrated with a similar carcinomatous growth.

A section through the heart muscle and the interventricular branch of the left coronary artery showed a dense round-celled infiltration of the connective tissue surrounding the coronary vessels, extending to the superficial layer of the cardiac muscle. The coronary artery appeared

normal. This microscopic appearance suggests an early pericarditis, and that the serous exudate found in the pericardial cavity was inflammatory rather than passive in nature.

This case was of course hopelessly inoperable, but the size and extent of the growth as revealed post mortem were a surprise. In considering prognosis and the feasibility of operation, perhaps sufficient attention was not paid to the enlarged and engorged veins on the chest wall or to the radiological evidence of mediastinal infiltration.

Some surgical attempt to relieve the recurring attacks of dyspnœa, which were extremely distressing and appeared likely to terminate fatally, seemed imperative. Low tracheotomy was impossible as one could not get below the mass.

Local anæsthesia was discussed but was considered impracticable.

The patient's painless end under anæsthesia was perhaps the most merciful termination of his illness and cannot have long anticipated his inevitable death from asphyxia.

Our thanks are due to Lieutenant-Colonel J. B. Grogan, R.A.M.C., for permission to furnish these notes for publication.

HYDROPHOBIA.

(Report on an outbreak of rabies amongst animals which occurred at Barrackpore Cantonment, Bengal, in November and December, 1933, and January, 1934, with one fatal case of hydrophobia in a European.)

By Major H. G. WINTER, M.C.,

Royal Army Medical Corps.

Owing to the large number of jackals in the area, rabies is endemic and usually assumes epidemic proportions in the early winter months. Each year steps are taken to combat the disease. Notices containing warnings and advice are issued by the Cantonment Authority, jackal shoots are organized and rigid registration of dogs is enforced; all strays dogs are destroyed by the dog-shooter, who is a British soldier permanently employed.

In spite of these precautions, an epidemic of rabies amongst animals, including one cow, broke out in November, 1933; the cases were largely confined to the dogs belonging to British troops, although an efficiently run kennel club is maintained by the Regiment at the Station.

On November 26, 1933, a puppy belonging to Serjeant W., 2 D.L.I., was diagnosed as suffering from "Furious Rabies" by the Veterinary Officer attached to the Barrackpore Society for the Prevention of Cruelty to Animals and destroyed. Unfortunately the brain was not preserved. It was reported that this dog had been bitten twenty-five days before by another dog which was subsequently destroyed for rabies.

The owner of the dog stated that he had been licked and was given a

seven days' course of treatment. Mrs. B., wife of another serjeant, stated that she had been bitten; her wounds were cauterized and she was given a fourteen days' course.

On November 26, 1933, Mrs. W., wife of the owner of the dog, reported with her $4\frac{1}{2}$ months' old baby. She stated that she had not been licked or bitten by the dog, but that the baby had been licked; there were no visible cuts or abrasions on the baby. Both she and her baby were, however, sent the same day to the Pasteur Institute, Calcutta, for advice; here Mrs. W. reiterated her statement that she had not been licked, and consequently the Superintendent decided that no treatment was necessary.

At 9 p.m. on January 6, 1934, Mrs. W. was brought to hospital; she stated that she felt ill on the previous night. She complained of severe headache and pain in the neck. She had spasm of the throat muscles and her expression was one of absolute terror. Difficulty in breathing when spasm occurred caused a series of short, sharp coughs, not unlike a bark. A noise, touching the head, a sudden light, any attempt to eat or drink, in short, any stimulus, brought on fresh spasms.

The patient's pupils were widely dilated, presumably as a result of fear, but reacted normally; her knee-jerks were increased and went into clonic contraction; all other reflexes were increased. The pulse was full, bounding and irregular. She complained of difficulty in breathing when lying down, and had to be propped up in bed. She could not swallow anything, not even liquids. Temperature on admission was 100° F., and remained so until the end when it went up to 101° F. Her mouth was at first dry, also probably largely due to the fear with which she was possessed, but later a glutinous, ropy saliva appeared which she was unable to swallow and had difficulty in spitting out. She suffered greatly from thirst, but even moistening her lips brought on spasm.

The patient's symptoms rapidly increased in severity and, although controlled by hypnotics, she became maniacal, struggling and throwing herself about and had to be forcibly controlled; throughout she was mentally distressingly alert.

Large quantities of hypnotics—in all morphia $3\frac{1}{3}$ grains, hyoscine grains $\frac{3}{100}$, and heroin $\frac{1}{12}$ grains—were given in the thirty-two hours she was in hospital. For the last eight hours morphia $\frac{1}{4}$ grain was given every hour. These amounts lessened the spasm and made her more comfortable, but were not sufficient to quieten her down completely.

The patient got progressively weaker and spasms more frequent; later twitching in the limbs became apparent and paresis of the arms and legs commenced. Finally she died from heart failure at 5.5 a.m., on January 8, 1934, thirty-two hours after admission to hospital and fifty-six hours after the first onset of symptoms.

The case throughout was most distressing to witness, more especially on account of the mental acuity of the patient and her obvious terror. Although the true diagnosis was never mentioned either by the patient or

attendants, it was only too obvious that she realized to the full her condition.

From interrogation of the husband and others it subsequently transpired that Mrs. W. had in all probability been licked but not bitten, and that she herself had carried the dog to the Society for the Prevention of Cruelty to Animals for destruction. It was further elicited that, although she was worried about it, she had definitely made up her mind not to be treated.

On New Year's Eve, five days before the onset of symptoms, Mrs. W. attended a dance in the Serjeant's Mess where she was kissed under the mistletoe by a number of individuals; later, on January 4, 1934, the day before she was taken ill, she took part in a Whist Drive at which she was in the habit of licking her thumb before handling the cards. These individual contacts occurred within six days of symptoms developing during which period she was considered contagious; they were, therefore, all treated.

In all, four contacts with the dog and seventy-two with Mrs. W. were traced, these included the medical officers and nurses in attendance. Amongst them were several local civilians and three Naval ratings from H.M.S. "Hawkins," necessitating a wireless message to the ship which was by that time at sea.

All contacts were given a seven days' course of five cubic centimetres per diem of Paris strain of "fixed" virus in carbolized five per cent emulsion of sheep's brain prepared at the Pasteur Institute, Calcutta School of Tropical Medicine.

Early in January 1934, another dog in the Regiment developed rabies and was destroyed, brain examination in this case was positive. After this all dogs were given one injection of twenty-five per cent emulsion as a prophylactic, but in spite of this another dog developed rabies. As a result of these cases, a further thirty-four contacts had to be treated, bringing the total up to 110, thus entailing a financial loss to the State of 500 rupees at 5 rupees per head, this apart from the loss of efficiency to the unit concerned.

In view of the seriousness of the situation, recommendations were made that all dogs should be tied up for ten days to ensure that they did not develop symptoms in that period, after which they should be destroyed.

It is a serious matter to part the soldier from his dog, but in this case any or all of the animals might have been contacts before their inoculation which is only sufficient as a prophylaxis against infection provided the dog is inoculated before contagion occurs. If the dog has been a contact he should be given a seven-day course of treatment, tied up for three months and kept under observation for a further three months; this would mean tying up the dogs throughout the hot weather and it was thought more humane to recommend their destruction.

SUMMARY.

The case of Mr. W. is of interest in that: (1) The incubation period was forty-one days which is the average period for a bite in an untreated case. As stated above, there is no evidence of a bite but only the probability of a lick. (2) The duration of the illness was fifty-six hours which is the average in an untreated case. (3) With one possible exception—pain at the site of the bite—she exhibited all the classical symptoms and from the first moment of seeing her the diagnosis could not be in doubt. In addition to headache, however, the patient complained of severe pain in the back of the neck and it is possible that she was licked there and so infected. A lick in this position would have the same effect as a bite elsewhere and would consequently account for the incubation period.

This case emphasizes the terrible nature of the disease and the necessity for medical officers to impress on all possible contacts that immunization by treatment is essential if there is the faintest doubt as to the possibility of infection.

All the information necessary as regards this disease will be found in the very excellent pamphlet issued to all hospitals and medical officers in 1933 by the Government of India.

I am indebted to Dr. M. J. Nicholas, I.M.D., Superintendent of the Pasteur Institute, Calcutta School of Tropical Medicine, for his advice, and to Mr. P. G. Morris, I.M.D., for assistance with the case and contacts. My thanks are also due to Colonel G. C. L. Kerans, D.S.O., V.H.S., I.M.S., Assistant Director of Medical Services, Presidency and Assam District, for permission to send these notes for publication.

A CASE OF HYDATIDIFORM MOLE.

By Captain C. E. ECCLES,
Royal Army Medical Corps.

HYDATIDIFORM mole, is a comparatively rare condition, occurring in about 1 in 2,500 pregnancies, so I think the following case is worth recording.

The patient, a multipara, aged 25, who had had two normal confinements previously, attended at the Out-patients' Department. She gave a history of slight uterine hæmorrhage for ten days prior to her visit. The hæmorrhage was accompanied by slight abdominal pain and vomiting. Her last menstrual period had occurred twelve weeks previously.

On examination, her uterus reached about two inches above the umbilicus, it was symmetrical, and had a boggy feeling. No fœtal parts could be palpated. Examination *per vaginam* revealed a soft patulous os, which just admitted the tip of one finger.

The patient was admitted to hospital and a radiogram was taken, but no evidence of a fœtus could be seen. There was, however, a large diffuse shadow, which extended over the abdomen.

The diagnosis of hydatidiform mole having been made, medical induction was tried, but this failed. The following day the patient was given a

general anæsthetic. Her cervix was dilated up to the largest Hegar's dilator, and a plug of sterile gauze was packed into the cervical canal. Following this the vagina was tightly plugged with sterile gauze. The patient was then taken back to bed and given ½ cubic centimetre of pituitrin ; this was followed in four hours time by another ½ cubic centimetre of pituitrin.

The patient had some good pains during the afternoon, and her uterus was contracting well. The plug was removed after six hours, but nothing came away.

The next morning the patient was given another general anæsthetic. On examining her a large portion of the mole could be felt at the external os. Her vagina was plugged again, and ½ cubic centimetre of pituitrin was given. Two hours later she started getting very strong pains, the plug was then removed, and shortly afterwards the mole was expelled.

The mole was very large and weighed 3½ pounds. The vesicles were tightly packed together; they varied greatly in size and the interstices were packed with blood. No portion of the fœtus could be found, although a thorough search was made through the contents.

The patient had a moderate hæmorrhage after the expulsion of the mole, but this ceased shortly afterwards. Salines were given per rectum and the foot of the bed was raised on blocks. Later on the patient was taken to the theatre. Her uterus was explored with a finger, and any remaining portions of the mole were removed. This was followed by a hot intra-uterine douche.

Owing to the liability of these cases to become septic, sterile glycerine was put into the uterus, and the patient was given a prophylactic dose of anti-streptococcal serum. The next day she had a slight temperature, and her pulse-rate was raised ; the intra-uterine glycerine and the anti-streptococcal serum were repeated. Following this, the patient's temperature and pulse-rate dropped to normal, and she made steady progress.

About fifteen days after the expulsion of the mole, the patient was curetted, and the curettings were sent to the laboratory for examination. The result of the examination showed the endometrium to be quite normal.

Two days after the curettage the patient had a fairly severe hæmorrhage, but this was controlled by pituitrin. She left hospital, and remained at her home for a period of three weeks, during which time she kept well.

About the twenty-first day, after attending to her household duties, she started a slight hæmorrhage, but instead of reporting sick she continued with her work. The loss became excessive, and she was brought in to hospital in a very exsanguinated condition.

She was given pituitrin and the foot of the bed was raised. Salines and glucose were also given and the hæmorrhage ceased. As a result of the hæmorrhage she had a very severe secondary anæmia. Injections of iron and arsenic were given intramuscularly and she had four ounces of liver daily.

On this treatment the patient improved very rapidly, and was discharged hospital in a very satisfactory condition.

Travel.

BEYOND LEH.

A SHOOTING TRIP IN LADAKH, 1926.

Being a Diary kept by

K. W. DICKSON, F.R.G.S.

(*Continued from p.* 440, vol. lxii.)

XXV.—DRAS: THE FOURTH OF JULY.

We had our camp in a lovely grove of young willows with nice moist turf underneath; no dry dusty sand as in Ladakh. Red bear had been seen not many weeks before in the nullah to the south and R. thought he would try to get one. So next morning at three o'clock he got up and started up the nullah. The moon was shining and I could see the Plough from my bed—it seemed to be resting on the top of a hill. I lay awake for an hour or more, then went to sleep and did not waken again until the sun was well above the horizon. It was a perfect morning, blue sky and a soft breeze, the air laden with the smell of willows coming into the tent. Even the dogs slept until after eight o'clock.

The night before we had not been able to get baths as the wood supplied by the chowkidar was so wet it would not burn and khansamah had difficulty in getting dinner ready by eight o'clock. I called for my bath—a morning bath being a luxury that can only be had on days spent in camp. Breakfast was served on a little table under the willows; porridge and cream and scrambled eggs with khansamah's very good girdle scones. The larks were singing, and to my great surprise I heard a cuckoo calling. It was really an Arcadian morning; I didn't want to do anything but just sit and be happy.

I gave my old topee another coat of brown water-colour paint, as it was looking shabbier than usual I thought, and there were more people on the road now. We were getting back to civilization. I had hardly finished when there was a shout, and R. and the shikari appeared. They had no luck; they had seen no red bear, only traces a few weeks old, but they brought back a nice marmot skin and a bundle of rhubarb; both very welcome, perhaps the rhubarb especially so, as we had by that time neither vegetables nor jam, and our potatoes were running low. Rhubarb seems to grow in quite high parts of Kashmir; later I myself found it coming up just where the snow had melted, in black moist soil, when the grass had not yet begun to appear.

We had a delightful quiet day lying on rugs under the trees; then dinner about six o'clock, and so to bed. It was a real Sunday for once.

The shikari brought down the visitors' book from the Dak Bungalow

and looking through it I found R.'s signature in May, 1912, when he was on his way to Baltistan after ibex. We were interested to see who had gone up "the road" to Baltistan while we had been in Ladakh.

The next day from Dras to Matayan was one of the easiest we had had. It was extraordinary trying to recognize the country we had passed through in April. There had been so much snow that the only feature of the landscape that was recognizable was a little wood beyond Pandras. Pandras itself looked so different, and the valley beyond, over which we had walked on hard snow as quickly as possible before it melted, was now a perfect meadow with many flowers.

We camped beside a stream of grey blue snow water at the foot of a nullah not far from Matayan village.

I was hot and dusty after the march and the stream looked cool and tempting. I put on my bathing dress and had a plunge in a pool just beside the tent. It was what it looked, icy cold, and it freshened me up a lot.

In the Dak Bungalows between Spittok and Macchoi the Joint Commissioner has supplied six novels in each bungalow for the use of travellers. These are a great boon and we appreciated them very much. They can be taken out one at a time from one bungalow to another. We had been reading one by Anthony Hope and lit a candle and sat up in bed to finish it, as it had to be returned next morning.

XXVI.—Baltal.

July Sixth (Tuesday we thought.)

How well I remember my feelings on reaching this place on the way up; very very weary after two days marching, nine hours each day in soft snow, and the pass still ahead of us. The fire in the grate only heating a small circle round it. Icicles all round the roof, and the floor of the verandah covered with drifts of snow. We did not go up to the bungalow again, and there were plenty of delightful camping grounds near the river.

It was a bitterly cold start that morning. I wore a jersey under my coat, but was glad to pin the woolly Ladakhi saddle-bag round me until after an hour and a half marching we got into the sunshine about a quarter past seven. R. had the gun with him as there was a chance of getting more marmots, and we saw four playing about. They were within easy rifle range but he could not get near enough with the gun; the ground was too open and there was no cover of any kind. They sat up, looking for all the world like little brown dogs begging, and then whistling, disappeared into their holes. I suppose these little animals must store food underground for the winter, for their holes must have been under many feet of snow for four or five months. Several times we crossed the debris brought down by avalanches; great piles of unmelted snow with rocks and stones embedded in it.

Progress was slow as the ponies slipped if they did not go very carefully. Soon we rounded a corner and came to the place that I had called "the great white valley"; its stillness and lifelessness were awesome, and we had been glad to leave it behind us. Now it lay before us a fertile meadow with a broad river running through it, *green* hills on either side, and flocks and herds of sheep, goats and ponies feeding everywhere. Kashmiri shepherd boys had their camps all over the valley, either using tents or some rough temporary shelter made from turf and stones. There were all kinds and colours of goats, some very big ones from the plains and all colours, brown, grey, white and black. It made me think of Laban and

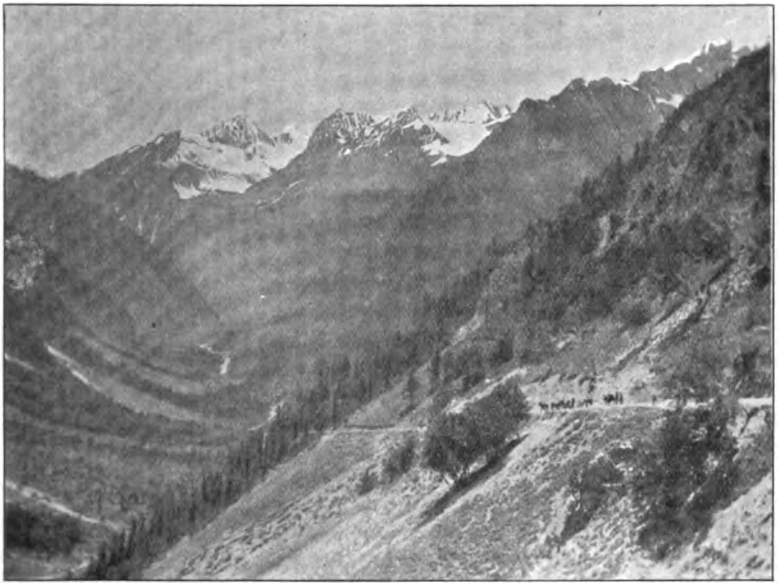


Fig. 28.—Our baggage ponies on the Zoji La path nearing Baltal.

his herds, but no water had to be drawn from wells here. It was a paradise of pasture!

Further down the valley towards Macchoi ponies covered the hillsides; I do not remember ever seeing so many ponies together before. We met families moving their live stock further up the valley. A herd of goats would come first, nibbling the grass as they came, then ponies, cows and dogs. The father usually carried a younger child on his shoulder, the child clinging to his neck in the usual Indian fashion. Another child aged two or three years was perched on a pony above piles of bedding; these children were not tied on, but the tiny hands clung to the rope which bound the bedding to the pony. I saw ponies going up most precipitous paths with children perched on blankets in this way. I thought for several days that the women in addition to carrying the family cooking and water pots,

carried their rations of flour in the black cloth across their backs, which is slung from their heads. I discovered later that it was their infants that were carried in the sling. No part of the baby was ever visible and it could get little or no fresh air, but probably the actual position in a sling of cloth is more comfortable than being carried in arms, but it could not be healthy. I do not understand how these poor women lived in the open as they do for months; during an illness they have no real protection from rain, and it could be very cold indeed on these high pasture lands when the sun was behind clouds for a few days.

I had not expected to see many wild flowers until we got to the other side of Zoji La, down in the Sind valley, but here to our delight before reaching Macchoi, knolls were blue with forget-me-not intermingled with a tiny white flower which I have seen cultivated in rockeries at home. Anemones were everywhere, tiny single ones, and larger ones growing in clusters. Wild strawberries were in flower, and yellow pontentilla, and we found at least four varieties of primula; the little short blue reptans, the common blue, the rosae, and a very small pale one. Buttercups were everywhere like a meadow in England in a buttercup year. There were yellow marigolds in thousands among the rubble where a stream came down the mountain side, and white marigolds on the level ground.

There a caravan of pack ponies passed up laden with a Sahib's kit. There was so much furniture we said to one another, "These people are not going far." Later two men walking, and a lady on a white pony, with a red parasol which looked very civilized, appeared over the rising ground. We said good-morning in passing, and then recollected the faces of people from Ambala who had been in Kasauli the year before. How small India is so far as Britishers are concerned!

There was still a mass of drifted snow to cross 20 or 30 yards long before we had gained the upper path which is cut out of the hillside. Looking down into the actual pass, still deep in snow, it was almost impossible to picture that we had climbed up there following an almost indistinguishable track. The gorge is impossible to look down on from the higher path, and the size of the cliffs opposite could be appreciated. It was terrible to think that three men and five ponies had been swept away by an avalanche three weeks after we had crossed. We heard that they had made a late start after the sun was up, and that was asking for trouble.

It was easy going down by the high path, and we soon came to a corner where we got a fine view of the Sind valley lying at our feet. R. took photographs, one looking down the Sind river and the other looking towards Amarnath. Coming up there had been nothing but snow, and here we suddenly looked down on this English park-land, with verdure-clad slopes above, then rising to snow-capped peaks. It was amazing; so delightful to smell pines again after all these months.

Our servants began to collect firewood; it was not sold at a premium here at this season. It had been brought down from the forests above by

snow drifts and was lying about everywhere. The tents were pitched on the meadow close by the river, a very turbulent stream compared with the river we had seen at Gund coming up.

XXVII.—Sonamarg.

The road and the scenery between Baltal and Sonamarg were both new to us. Only one or two snow-capped peaks were familiar. We rode most of the way as it was a warm morning and the path was good.

There were quite a number of people going up to Baltal; ladies riding, and a party of people who had a special "doolie"—a variety of dandy carried by coolies for their dogs. It looked as if we might meet many more travellers on the road before reaching Sonamarg, but we got there sooner than I expected. Those nine miles did not take us nine hours this time.

We called at the Post Office for our mail and were glad to find a parcel of stores ordered from the Army Agency in Srinagar. We opened new tins of butter and jam for lunch, which we ate sitting under the pines on the hillside. The baggage soon made up on us and the shikari said he knew a nice spot a mile further on where "Sahib log" usually camped, so we followed on later. It was a very warm day so I sent word with the tiffin coolie to be sure and pitch our tent in a shady place. We wandered along with the dogs shortly afterwards by a small path. There were one or two flowers we had not seen before, Jacob's Ladder and a small primula.

The camp was in a delightful spot beside a wood, but our tents were in full sunshine, while the kitchen ones were under the trees. However, we took a rug out and had tea in shade. The hills opposite were perfect; very satisfying to look at in the evening light. Barren Ladakh has a fascination which is its own peculiar treasure, but the smell of trees and grass and flowers and the very dampness in the atmosphere were soothing and restful to us who had been without them for so long.

Sonamarg was, I believe, a great camping ground in the 'eighties but since Gulmarg has been built and Pahlgam developed, it has lost its popularity. It must be an extraordinarily good centre for climbing and walks, but as there is only a footpath from Gunderbal to Sonamarg, four coolie stages, and there are now motor roads to Gulmarg and Pahlgam, one can understand why they have developed. I have met old ladies, officers' wives, who have asked, was it the same still; it was forty years ago they were there; and I was able to say, "Yes, I am sure it is just the same."

The snowy peaks to the west were all rosy in the morning light before we left our camp next morning. We saw the little hut where we had taken shelter under the gables and hurriedly eaten our lunch during a snowstorm. Three and a half months before no stream had been visible, but now a river as big as the Indus at Leh in May was tearing past us with such force and noise we could not hear each other speak at all. There was still snow by the river but nowhere near our path. Everywhere here there was a heavy

undergrowth of some weed which has a flower like Queen of the Meadow; its smell is somewhat similar too, very sweet but heavy.

A large caravan of over 300 ponies and mules passed up the road on its way to Leh while we were resting. A large Hindu family was with it, women and children all being well mounted on sturdy ponies. We were glad to be off the road while it passed as the dust was considerable.

We rested at midday, and had tiffin under a big pine tree about a mile from Kulan, where we camped for the night. We had planned to cross from the Sind valley to the Lidar. There were good hunting grounds for red bear off the higher waters of the West Lidar and R. wished me to see the Lidar valley. The path to the pass at Khemhar branches off the Sind at Kulan, so we hoped to start next day. The shikari had great arguments with the local coolies that night, who said the pass was not open yet, and they could not be forced to go, and so could demand what rates they liked. They brought us chits from a man who had crossed by an easier route, they said, ten days before. He had been obliged to give them double the the usual rate. Our shikari argued that the weather was better now, while they argued that the weather was the same, and this was a more difficult route. At last arrangements were made for 25 men at a little less than double the usual rate, which was almost £10, to take our kit to Pahlgam, a distance of 5½ marches. It seemed a lot at the time, but I didn't think so later when I had seen the pass. The shikari suggested a pony for me for the first stage of seven miles; after that I must walk as the road beyond was impossible for ponies.

XXVIII.—Zaiwan. A Perfect Camping Ground.

July 9th. If we had been trying to find a change from the camping grounds of the last two months we could not have found a more complete one than up at Zaiwan. From Kulan, after crossing the stream, the path, a very rough one, wound up and up. We climbed at least 2,000 feet in the deep shadow of a thick pine forest all the way, then suddenly emerged into sunshine on the comparatively flat grazing ground called Zaiwan, where we camped. The pines were very tall and the forest thick to the north, but there were vistas across the hills above Sonamarg across the valley, and to Haramokh away to the north west.

After settling in to camp we tramped for about three hours to see if there were any marmots in the near neighbourhood but did not even see any holes. There were sheep, and sheep, and sheep, everywhere. A flock of a few hundreds had their temporary home about 500 yards from us. The shepherds and their families cooked their food and slept and ate under a large pine tree. They had no other shelter. We could only get sheep's milk, but it was very rich and very good—the best cream we had since we got yak's milk. The sheep went abroad grazing in the early morning and in the afternoon. During the heat of the day they were herded together

under the trees, and the servants said they ate salt. I certainly saw rock salt lying about. The camp smelt even stronger than on a big sheep farm in Scotland the day before the dipping when the sheep are collected in pens.

Garry watched them, and I had to keep an eye on him. Kelpie was so wearied with chasing wasps that he lay in the tent. I had never been stung by a wasp or a bee in my life, but these wasps were most aggressive; no buzzing about or giving warning; they stung you before you had time to see them. My legs were covered with stings.

The shikari said there were bears near at hand. We met a man who had seen two red bears five days before five miles away, so R. was planning another early morning expedition. Not so long ago I would have wondered at there being so many sheep when bear were about. I did not know that bear are strict vegetarians.

Having had no fresh meat for some time the shikari suggested that we should buy a lamb from the shepherds and it would give the whole camp a change of diet. I sent him off to inquire the price, and he came back and said, "He want three rupees four annas, Memsahib," so I agreed. One doesn't buy a whole lamb for about five shillings every day, even although it was not very large. We had plenty of time to read our *Sunday Observer* and noticed with satisfaction that lamb was 1/10½ a pound in London!

We were reduced by now to our last bar of Sunlight soap. Toilet soap was finished before we left Kargil, where I had hoped to buy some. R. had rather overestimated his requirements in the way of shaving soap and we had two or three sticks in hand. Travellers on the road sometimes exchange superfluous stores. We thought of offering to exchange the shaving soap for toilet soap, but on thinking it over we did not quite like to ask some of the bearded boys we met if they wanted any shaving soap; the inference was too obvious.

We arrived at Zaiwan on a Friday morning. That evening R. got word again that red bear had been seen, so on the Saturday he was out from half past three in the morning until five in the afternoon. They came back tired and disappointed, not having seen any tracks. The shikari said there were so many sheep and shepherd folk about that the bear had to go much higher up the hills to be undisturbed.

I was thoroughly lazy while R. was away that day. I carried a rug and books about fifty yards above the camp and sat under a pine tree where I could get a view of the Sind valley. The dogs were quite content to be lazy too.

If we reached our camping ground after the transport and servants had arrived, we usually found the tents had been pitched looking straight into a wall or facing up a hill, and this time was no exception. We could see nothing but pine trunks from the tents. There were beautiful camping grounds a hundred yards further up, with a magnificent view, and a spring of clear water beside them.

Next day broke cloudy and sultry--such a change from the climate of

Ladakh ; then the rain came down and we were storm-stayed for three days. When the rain ceased the air was so damp, nothing would dry, so there was no chance of being able to move the soaking tents until we had either a strong wind or some sunshine. The cuckoo called all day even in the rain, and we heard wood pigeon too, so took out the gun and went for a stroll in the mist and R. brought one down.

The flowers and green things had such a wonderful smell that morning. The forest was full of plants with dainty leaves like columbine, thalictrum and maidenhair fern. There was white columbine at this level, and the deep purple variety is found higher up. There were tiny yellow pansies all over the open grazing ground, and little purple violets under the trees quite near.

The rain was very depressing. We heard it in the night and knew there was no hope of getting away next morning. I did all possible mending and sorted out the yakdans. We both wrote so many letters that our writing paper was nearly finished.

Milk was very cheap, about twopence a quart, and when meat was scarce we gave the dogs milk, so we used two quarts a day. The cream was so rich we took it off and put it in a lime-juice bottle. In twenty minutes there was such a large lump of butter that it could hardly be coaxed out of the narrow neck of the bottle. After eating tinned butter for three weeks, it tasted specially good. Khansamah played up very well ; with a little help from me in suggesting dishes he managed to give us a good variety with the few stores we had left. These wet days we dined at half past six and went to bed immediately after. We had a brazier brought inside the tent with red charcoal in it as everything, our bedding included, was heavy with damp and we ourselves were not too warm.

Garry caught a mouse in the lunch basket, and that night he snuffed and snuffed and went outside once or twice to investigate. I wondered what he was doing ; he would certainly have given the alarm if any men had been about, but we understood when the shikari told us in the morning that a Barra Singh (a Kashmiri stag) had come to their tent door in the night. Our neighbours the shepherds had moved the day before with their flocks to other pastures. The sheep left the ground quite bare ; they ate even the leaves of the dockens, leaving the stalks bare.

(*To be continued.*)

Current Literature.

WALLACE, J. S. **The Best Means of Preventing Dental Decay in Man and the Uselessness and Cruelty of the Projected Experiments of the International Dental Federation.** 21 pp. [Numerous refs.] 1934. Geneva: Bureau International Humanitaire Zoophile, 4, Cour St. Pierre and London: 15, St. James' Place, S.W.1. [6d.]

HOPS, W. **Diet as the Cause and Prevention of Dental Caries.** *E. African M.J.* 1934, v. 10, 318-30.

KOEHNE, Martha, BUNTING, R. W., and HADLEY, Faith P. **A Review of Recent Studies of the Cause of Dental Caries.** *J. Amer. Dietetic Ass.* 1934, v. 9, 445-61. [60 refs.]

Of these three articles the first is written as an essay in the competition for prizes offered by the International Humanitarian Bureau of Geneva as a counterblast to that of the International Dental Federation for experiments to show the result of root-canal treatment, having for its object can effective and lasting sterilization of the canals which would not become foci of infection. The author of this essay obtained the second prize.

An historical survey of the literature on the cause and prevention of dental caries occupies a considerable part of the essay and supports the thesis that the best way to avoid experiments on animals as a means of proving the toxic effects of germs in root canals, is to prevent the teeth from being attacked by caries and by so doing to avoid infection of the root canals. He brings a large amount of experience and evidence in favour of his contentions which find further support from the bibliography of sixty-four references.

The second article is more of a résumé of reading done by the author than a record of personal experience, its object apparently, as it was read at a meeting, was to provoke a discussion, which might have proved fruitful had it been recorded. The conclusions are the usual ones advanced by similar communications.

The third article is of a different nature since it gives a reasoned dissection of the various current views by authors who have experimented on most of the diets described. They give results which are contradictory and are not afraid to admit that these are puzzling and up to the present baffle their attempts to furnish an explanation. They are not out to prove any one theory of dental decay and are quite impartial in their judgment of other workers in the same field whose findings are directly opposed to their own. They have found that caries was produced in children whose diets were recognized generally as adequate for normal health and growth. Close observation over a definite period showed that the metabolism of these children was normal, their appetites were healthy, the gains in height and weight were also normal, in short they were normal children.

Recent researches are reviewed, together with reports of personal experiments, and a conclusion is reached in agreement with that of most impartial authorities that the cause of caries depends on no single principle which can be applied universally in prevention ; that there are undoubtedly persons who are immune to this disease, whose teeth are unaffected by any diet unless some serious constitutional disturbance arises to bring about a change in this immunity, the nature of which is at present inexplicable; there are others who exhibit a susceptibility unaffected by any diet however sufficing in all the necessary requisites and with a low sugar content. The authors admit that the teeth of those who are moderately prone to the disease may be protected by diets low in artificially sweetened foods. The evidence is strongly in support of the finding that *Bact. acidophilus* growing undisturbed in areas of the mouth may be the primary cause of caries, that the kind of food may favour this by the provision of the necessary medium of acid fermentation, and that caries will result irrespective of the nutritional balance of the diet unless the shape of the teeth is unfavourable for the retention or packing of the food and its fermentation.

L. LINDSAY.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 6.

KETTLE, E. H. **Experimental Pneumoconiosis: Infective Silicatosis.** *J. Path and Bact.* 1934, v. 38, 201-8, 15 figs. (4 coloured) on 6 plates. [11 refs.]

This paper, which records the most recent results obtained by Professor Kettle in his experimental study of the pathological effects of silica and of allied dusts, breaks new and important ground. The view most generally held in regard to the pathogenesis of pulmonary silicosis has assumed the primary pathogenic agent to be silica itself, acting alone and unaided on the pulmonary tissue. On this primary silicosis a secondary bacterial infection —in particular tuberculosis—is often grafted, the frequency and severity of this secondary infection constituting the main menace of the disease. That silica does act in this way under experimental conditions, so damaging the tissues as to create foci in which bacteria, and particularly tubercle bacilli, flourish very readily, the author's earlier studies have shown; but the experiments that he records in this paper suggest that, at least in regard to pulmonary silicosis as it occurs in nature, we may have been putting the cart before the horse. The difficulty of inducing pulmonary fibrosis in experimental animals by inhalation experiments have been emphasized by many workers in this field, and there is general agreement that dusting experiments of this kind must be continued for months or years if any reliance is to be placed on the results. Even if an active dust is introduced in suspension directly into the trachea, a method adopted by the author in earlier studies, months or years may pass before a definite fibrosis develops.

The present series of experiments was undertaken to study the possible effect of a bacterial infection in promoting silicosis. In order to eliminate the progressive lesions induced by bacterial multiplication and invasion the

agent selected for trial was a saline suspension of a B.C.G. strain of tubercle bacillus, killed by autoclaving. Guinea-pigs were injected intracheally with a suspension of dust alone, a suspension of dead tubercle bacilli alone, or with a mixture of the two reagents. They were killed and examined at various intervals thereafter.

The results were very striking. The naked-eye appearances of the lungs into which dust alone had been injected, and of those that had received the mixture of dust and dead tubercle bacilli, did not differ greatly, but profound differences were revealed on histological examination. The introduction of the dust alone was followed by a rapid and pronounced catarrhal reaction, the dust particles being engulfed by single or giant macrophages within a few days. Part of the dust was removed to the regional lymph-glands, but much of it remained in the alveoli for long periods of time without causing definite fibrosis.

A very different result followed the injection of mixtures of dust and dead tubercle bacilli. There was the same phagocytosis of the finer dust particles, and encirclement of larger particles by giant or syncytical macrophages, but there was a much more intense emigration of mononuclear cells, and areas of lung became solid with dust and exudate. In these foci large clumps of bacilli were present. In course of time these diminished in number, in part as the result of lysis, in part by phagocytosis and subsequent removal; but before they disappeared a localized necrosis had usually developed, and the necrotic areas became surrounded with broad zones of fibrous tissue. The resulting nodular lesions, which are figured in a series of plates, resembled very closely those met with in human tuberculo-silicosis. In other areas a coarse reticular fibrosis replaced the nodular lesions, and this condition also has its counterpart in the pathology of the natural disease in man.

The injection of tubercle bacilli alone, or of tubercle bacilli mixed with inert dusts, such as wellingtonite (aluminium oxide), or iron-coated silica, failed to produce any similar lesions.

It would seem that bacteria, or bacterial products, play a very important part in sensitizing the lung tissue to silicosis. "Infective silicosis," would, on this basis, indicate silicosis occurring as the result of a primary infection, rather than a tuberculous or other infection occurring as the result of a primary silicosis. That the silicosis aggravates the infection, there is, of course, no doubt; but it would seem that we must think in terms of two pathogenic agents working together, thus displacing the silica from its major primary rôle. The importance of this new view-point in regard to the industrial side of preventive medicine is sufficiently obvious.

A further point of interest is that the dust used in these experiments was china-clay (kaolin, an aluminium silicate) .It has been commonly held that this dust, in common with all other silicates except asbestos and in contradistinction to uncombined silica, is harmless on inhalation. Previous studies by the author, in which kaolin was injected into the subcutaneous

or other tissues, had led him to the view that this dust is, in fact, active and dangerous, a conclusion which the present series of experiments has amply confirmed. W. W. C. Topley.

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Twort, C. C., and Twort, J. M. **On the Prevention of Mineral Oil and Tar Dermatitis and Cancer.** *Lancet.* 1934, February 10, 286-7.

Investigations carried out over several years are summarized. Certain mineral oils are more carcinogenic than others; refined textile lubricating-oil is the most carcinogenic, being more active than the dirty looking crude material from which it is prepared, while internal-combustion engine lubricating oils are least active. Oils vary according to geographical area of origin; the more fully hydrogenated an oil, the less is its carcinogenic activity. Treatment of oils with sulphuric acid reduces carcinogenic potency; and any process which hydrogenates or saturates oils, such as oxidation-reduction, polymerization, or selective extraction, has the same effect. The refractivity constant of a mineral oil is closely related to its carcinogenic potency; this fact can be used practically when choosing lubricating oils for mule-spinning. Smearing the exposed parts before work and after the evening bath with a mixture of equal parts of anhydrous lanolin and olive oil prevents the occurrence of mineral oil dermatitis and cancer, and also of tar dermatitis and cancer. E. L. Collis.

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Rogers, Doris G. **An Inquiry into the Diet and Household Expenditure of Unemployed Families.** 13 pp. 1933. December. The Newcastle Dispensary. [6d.]

The family budgets of 33 unemployed families (22 living in slum areas and 11 in New Housing areas), and 3 employed families (living in slum areas) were investigated. Contributory factors such as conditions for food storage, facilities for washing, presence of ovens and incidence of household pests were also enquired into. All the unemployed diets were very deficient in first-class protein. In the slum areas this deficiency amounted to (on the British Medical Association standard) 51 per cent, and in the New Housing area 65 per cent; the employed diets showed a deficiency of 39 per cent. The fat in the unemployed diets was lacking in quantity and quality; in the slum areas the deficiency was 23 per cent and in the New Housing areas, 26 per cent; the employed diets showed a surplus of 10 per cent. There was a deficiency of total calories in the slum unemployed of 20 per cent and in the New Housing areas, 16 per cent; there was no deficiency in the employed. The greater deficiencies in the New Housing areas are the result of higher rentals, despite economies in other essential expenditure, the average rent being 9s. 2¾d. (30 per cent of total income) as compared with 5s. 10½d. (18 per cent of total income) in the slum areas. In the slums the cost of food is increased by the necessity for buying daily quantities owing to the lack of storage accommodation. In the New

Housing areas this difficulty does not exist. In the slum families where a larger food income is available the increase is used for food and in general wisely spent. The average weekly food income in the slum areas was 3s. 5¼d. per "man" and in the New Housing areas 3s. 1¼d. per "man" as compared with the British Medical Association standard of 5s. to 5s. 10½d. per "man." H. N. H. GREEN.

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FOX, F. W. **Diet in Relation to Health in South Africa. Biochemical Aspect.** *S. African M.J.* 1934, v. 8, 3-15. [46 refs.]

Maize is the most important agricultural product in South Africa, taking up 40 per cent of the cultivated land. In general it is little inferior to wheat as a source of food. There is less protein and mineral salts, more fat and about the same amount of carbohydrate in "whole" maize flour as compared with "whole" wheaten flour. Recent work shows that the biological value of "whole" wheat protein is about the same as that of "whole" maize protein. Though the maize protein, prolamin (zein), is deficient in lysine and tryptophane the glutelin fraction contains amounts of these acids similar to wheat glutelin.

The chief objection to a large maize diet is the excess of carbohydrate compared with protein. It should be supplemented with protein-rich foods such as milk, meat, fish, ground nuts and beans. A mixture of mealie meal, kafir corn, ground nuts and soya bean, treated so as to prevent deterioration on keeping, is on trial. The prejudice against yellow mealies, in favour of white, which exists in some parts of South Africa, deprives the native of a valuable source of vitamin A. The use of the soya bean and a greater consumption of fish are suggested as possible methods of providing a protein supplement to the maize diet. The mineral intake of the white population is probably very similar to that found elsewhere and the calcium intake must often fall below the optimal level, but the Poor Whites and the Natives (who often live on an exclusive diet of mealies for considerable parts of the year) must often have an extremely low calcium intake. Though this deficiency shows itself in other ways it is a striking fact that rickets, osteoporosis and caries are rare, which can only be due to the abundant supply of vitamin D from solar irradiation. In fact, in some cases, trouble must be looked for in the direction of over-calcification.

A scheme for a suggested nutritional survey in South Africa is given. Amongst the suggested measures are those of soil survey, the improvement of pastures through attention to grasses, the use of fertilizers (particularly with reference to the well-known phosphorus deficiency in the soil), the study of native foods and food customs and the particular deficiencies existing in various areas.

[This article contains many valuable suggestions and collected data as to the composition of South African foods, of direct interest to all health workers in this part of the world.] H. N. H. GREEN.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 6.

CLUVER, E. H. **Diet in Relation to Public Health in South Africa.** *S. African M.J.* 1934, v. 8, 19-22.

The danger of dietary deficiencies chiefly arises from economic causes and for the great bulk of the population of South Africa this factor gives rise to the following deficiencies: Protein of high biological value (with excess of carbohydrate, especially of cereal starch), minerals and vitamins. All persons past babyhood should receive 100 grammes of animal protein daily or a larger amount than this of vegetable protein. The dangers from excess protein in the diet are probably slight. Mealie meal is a useful food but when consumed almost exclusively, as it is by practically the whole native population and a very large section of the poorer European population, it is an unmitigated evil. The natives in the gold mines usually arrive in a malnourished and often subscorbutic condition; they leave in six to twelve months in vigorous health although they have worked under bad hygienic conditions. This must be due to the supplementary articles of diet required by Government regulations. These include 8½ ounces of meat, 3 ounces of beans, half of which must be germinated for the production of vitamin C, and 5 ounces of vegetables.

Though there are no rickets, periods of insufficient vitamin D from solar irradiation combined with a large consumption of anti-calcifying cereal must interfere with Ca-P metabolism and lay the foundation for malformed and carious teeth in children. Deficiencies in vitamins A and B_1 are not common in South Africa, but the vitamin B_2 margin is narrow in the mealie-meal eating communities as illustrated by the periodic outbreaks of pellagra in Bantus. Many natives in Zululand and the Transkei are apparently in a sub-pellagric state, readily convertible into overt pellagra by hard work in the sun. Mealie meal contains no vitamin C and scurvy is not uncommon in the Native territories and the disease may become manifest when hard labour is done, as in the mines, when, unless the diet is fortified with germinated beans, vegetables and fruits, and not too strenuous labour is demanded from the raw recruits, scurvy soon appears.

In the territories the diet is unsatisfactory, for only from March to June is the staple native diet, mealie-meal, supplemented by sufficient meat protein and foods containing sufficient vitamins B_2 and C. There is little to be wondered at that the infant mortality and general death-rates are so high. From the economic aspect alone the diet should be improved, for a large proportion of the adult males in the territories are found to be medically unfit for work in the mines. In the poorer sections of the European community the difference in diet from that of the territories is only one of degree.

H. N. H. GREEN.

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Reviews.

AIDS TO SANITARY SCIENCE AND LAW. (Second Edition). By C. F. White and H. Willoughby. London: Baillière, Tindall and Cox. 1934. Pp. vii + 321. Price 4s. 6d.

Drs. White and Willoughby have produced an excellent little book, which is a miracle of condensation.

Dealing with the whole subject of sanitary science in 314 small pages, this latest addition to the Aids Series is only able to deal with basic facts, but so skilfully are these arranged and presented that a very readable book has resulted.

The information conveyed is accurate and up to date, and should be of great assistance to medical students and to candidates for the certificate of the Royal Sanitary Institute and Sanitary Inspectors' Examination Joint Board, especially when revising the subject immediately before examination.

The book is clearly printed and is provided with an excellent index.

F. H.

BRIGHT'S DISEASE. By J. Norman Cruikshank, D.S.O., M.C., M.D., F.R.F.P.S.Glas., M.R.C.P.Lond. Edinburgh: E. and S. Livingstone. 1933. Pp. x + 208. Price 10s. 6d. net.

The study of kidney disease is one which has advanced so greatly in recent years that there is little resemblance between a modern book on this subject and one published but twenty years ago. One can hardly say that the subject has been simplified, indeed it is now extremely complex and requires a good deal of patient study to enable any student or practitioner to grasp even the main essentials of the series of problems presented by diseases of the excretory system. For this reason we welcome Dr. Cruikshank's book for it is clear and not too long. With the chapter on Kidney Function Tests, we are not impressed—this vexed subject could be dealt with more clearly and definitely to the great advantage of the book. Tests in the hands of the clinician should be simple and easily interpreted in probable terms of kidney function. A counsel of perfection no doubt, yet unless the tests approximate to something of the kind they are of little value.

The author adopts a simpler classification of Bright's disease than most of the modern writers.

We agree with him that it is quite impossible to classify Bright's disease satisfactorily on a combined clinical-pathological basis, and that therefore in a practical book it is better to classify on a basis that will direct treatment upon proper lines rather than upon one which is bound to satisfy scientific exactitude. Herein lies one of the best features of the book. For those who wish to refer to them alternative classifications of the British and American schools are given at the end of the volume. The hæmorrhagic, vascular, and degenerative types of kidney disease are well

and clearly explained ; the chapter on Treatment is illustrated by menus for medium, low, and high protein diets. This is a book we recommend to anyone who wishes his conceptions of Bright's disease to harmonize with modern knowledge of this difficult and complex subject. J. H.-S.

THE ORIGIN OF CANCER. By J. P. Lockhart-Mummery, M.B., B.Ch.Cantab., F.R.C.S.Eng. London: J. and A. Churchill. 1934. Pp. 150 with 29 Illustrations. Price 10s. 6d. net.

This book is an attempt to explain the origin of new growths by the application of the Gene Theory of Heredity. The author suggests that the origin of new growths lies in a single cell in the body of the individual and that the change from a normal cell to an abnormal cell depends upon the mutation of certain genes in the nucleus of that cell. The actual mutation may be due to either exogenous or endogenous factors, but it also depends upon the stability of the nucleus. Many workers have brought forward evidence to prove that there is an hereditary tendency towards neoplastic diseases which may be passed through the germ plasm from one individual to another. Mr. Lockhart-Mummery's view is that this hereditary tendency is exhibited in the instability of the nucleus of a somatic cell and that such a cell, under the influence of certain factors, develops into the centre of a new growth.

Although the theory is a very convenient one it hardly explains, as it stands, the origin of all forms of neoplasms. Also it would appear to offer little help in attempting to approach the cancer problem from a practical standpoint.

Many of the statements in the book are rather too sweeping and others are reiterated too often. There is evidence also of a certain lack of care in preparing the manuscript. For instance, on p. 55 we find, "Whether or not a chemical reaction occurs, or does not occur, between the molecules. . . ." Zoological names are written without any uniformity ; in one place we find *Drossophilia simulans*, in another, *Tænia crassicollis* and yet in a third homo-sapiens. Faults of this type are not uncommon and mar the appreciation of the book. H. J. B.

AN OUTLINE OF PRACTICAL OBSTETRICS FOR NURSES. By R. S. S. Statham, O.B.E., M.D., Ch.M., F.C.O.G. Bristol: John Wright and Sons, Ltd. 1933. Pp. 139. Price 2s. 6d.

This little book admirably fulfils the author's claim. It has been written with the object of revising work when preparing for the Central Midwives' Board examination, and, as it measures about six inches by four inches by less than half an inch, it can be easily carried in a pocket, or lady's bag, and be available to refer to during those dreary hours of waiting "On the District."

Though the book is small, the contents have not been skimped ; in fact, it contains more than a nurse is likely to be expected to answer at the

examination. It is well and clearly written and, most important in a book for revision purpose, it has a good index.

There is a Comparative Table of Mechanisms, which should be useful to the pupil midwife trying to recall the elusive details of the mechanisms of the various vertex, face and breech presentations.

It is good value for half-a-crown. J.W.L.

CLINICAL CONTRACEPTION. By Gladys M. Cox, M.B., B.S.Lond. London Messrs. Wm. Heinemann (Medical Books), Ltd. 1933. Pp. x + 173: Price 7s. 6d. net.

So much of what has been written on this subject for the lay public is biased and ill-informed, that an up-to-date, uncontroversial book, written by a recognized expert for the use of doctors, meets a real need.

In "Clinical Contraception" Dr. Cox has produced such a book, and her qualification for such a task is beyond doubt.

In some 173 pages she describes practically all the known methods of contraception, indicates how they should be employed, and discusses their advantages and disadvantages without bias.

The introduction and the fitting of the various mechanical contraceptives are clearly described and illustrated by excellent prints and diagrams. The methods of instructing patients in the fitting and use of the various occlusive pessaries are given in detail and are obviously practical.

The chapter "Contraception for the Abnormal Woman" is particularly valuable and interesting, impressing the necessity of treating each case on its merits, and using the method or methods most suitable for the different needs. Many failures are due to practitioners advising one method to all and sundry, irrespective of their individual requirements and purse.

In the appendices are included lists of Birth Control Clinics in England, Scotland and Wales to which patients may be referred, and of the various contraceptives on the market and their manufacturers.

The book is well printed on excellent paper, and is easy to read.

C. A W.

THE EAST RIDING MEDICAL JOURNAL. Editorial Offices: 51, High Street, Hull. Price 1s.

The first number of the *East Riding Medical Journal* was published in November, 1933, and the editor states that the Journal has come into being for the purpose of allowing the doctors and dentists of the East Riding of Yorkshire to air their views on any professional matter, local or national. The Journal is to be published monthly.

The special medical articles in the first number are: "Psychology and the Clinician," by F. C. Eve, "Modern Views on Gall-Bladder Disease," by R. B. Blair, and "The Technique of Regional Dental Anæsthesia," by R. M. Clegg.

Several subjects are dealt with in the editorial section. The remainder of the number is made up with reviews of books, notes on drugs,

correspondence, "Practitioners we have met," with a cartoon, and an article on modern motoring.

The Journal is beautifully printed on excellent paper. The editor states that only firms of the highest standing have been allowed to advertise in the Journal, and that the number of applicants for advertising space was infinite.

Notice.

LIST OF BOOKS RECEIVED AT THE ROYAL ARMY MEDICAL COLLEGE LIBRARY DURING THE PERIOD JANUARY 1 TO MARCH 31, 1934.

Author(s)	Title of Work	Grant or Not
Derache, D. P.	Jubilee Number in honour of Dr. Paul Derache	Sir H. Fawcus
Auty	Modern Inhalation Therapy	Library and J. Committee
Various Authors ..	Studies and Nature of Cancer	British Empire Cancer
Bryan	Roundabout Harley Street	Library and J. Committee
Collie	Recent Advances in Medicine and Surgery ..	,, ,, ,,
Dartford Urban Council	Souvenir of the Incorporation of Dartford as a Municipal Borough	,, ,, ,,
H.M.S.O...	Spirit Tables of Specific Gravity	Grant
Gunn	The Bed Bug. Pamphlet	,,
Morson	Urinary Infections	Library and J. Committee
Webb	Diets	,, ,, ,,
Hutton	The Last of the Taboos	Lt.-Col. J. H. Spencer
Appleton's	The Practitioners Library:— Vol. V—Traumatic Surgery Vol. VI—Obstetrics and Gynæcology	Grant
Atack	The Chemist Year Book 1933	,,
Walker	Meat and Food Inspectors' Examinations ..	,,
Lines	Science of Meat. Vol. XI	,,
Douglas	Encylopædia of Meat Trades	,,
Bruce & Dilling	Materia Medica	,,
Price	Medicine. 2 copies	,,
Rose & Carless	Manual of Surgery. 2 vols.	,,
Fraser	Anatomy of the Human Skeleton	,,
Topley	Outlines of Immunity	,,
Price-Jones	Blood Pictures	,,
,,	Red Blood-cell Diameters	,,
Gardner	Bacteriology	,,
Savill	Clinical Medicine	,,
Muir	Textbook of Pathology	,,
Sibley	Diseases of the Skin	,,
Boyd	Surgical Pathology	,,
Allen's	Organic Chemistry. Vol. X	,,
Fuch's (Brown)	Diseases of the Eye	,,
Royal College of Surgeons	Examination Questions. 1932-33	,,
Queen Charlotte Hospital	Textbook of Obstetrics	,,
Howard & Perry ..	Practice of Surgery	,,
Brain	Diseases of Nervous System	,,
Hammett & Nevill ..	Handbook of Meat	,,
India Government ..	Fauna of British India. Vol. V—On Diptera. Family Culicidæ.	India Government

ERRATUM.

R.A.M.C. Journal, July, 1934.

Page 46, line 1: *For* "additional" *read* "inhalational."

September, 1934. Vol. LXIII.

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Royal Army Medical Corps

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Journal
of the
Royal Army Medical Corps.

Original Communications.

FURTHER EXPERIMENTAL TREATMENT OF GONORRHŒA BY SALINE IRRIGATIONS.

By Major L. B. CLARKE,
Royal Army Medical Corps.

Gonorrhœa continues to present a problem of perplexity to all who are interested in the health of the Army, and it remains one of deep concern to those engaged in its treatment. The disease still maintains its well-known chronicity, cases may stay many months in hospital and we are still without any reliable therapeutic means whereby this period of inefficiency can be curtailed.

That the disease is more often than not a perfectly trivial and localized one only adds to the seriousness of the situation. Much has been attempted since the War, many forms of treatment have been tried, but we are still more or less in the same position as we were twenty years ago.

Those of us who have given thought to the subject ask what can be done to remedy this defect? The answer can only be sought through a consideration of the urethral mucous membrane and its relation to the habits of the gonococcus.

The mucosa is a very delicate tissue penetrated by numerous minute openings and the organism is one whose chief object appears to be that of hiding in some inaccessible recess. The picture of the fully established disease is that of a highly inflamed mucosa, often studded with numerous follicles containing gonococci.

How is such a condition to be treated? On general principles one

would suggest certain desiderata: (1) The removal of the gonococci by some simple method which will cause as little harm as possible to the urethra; (2) the prevention of follicles; (3) the building up of the patient's resistance.

Dealing first with (1) we have to consider the choice of irrigating fluid. We should naturally insist on the fluid being reasonably toxic to organisms and we should also most certainly insist on its being of such a nature that it is harmless to the highly inflamed mucosa of the urethra. Yet, what do we find in perusing a list of irrigating fluids which have been more or less standard treatment for the last twenty years? We find that they are nearly all very potent as antiseptics but at the same time very irritating. The application to a delicate and inflamed tissue of a concentrated and irritating solution cannot be defended on logical grounds. It would therefore appear desirable that our irrigating fluid should be non-irritating.

Dealing next with (2) we have to consider the prevention of follicles. It is considered that the astringent action of these powerful antiseptics tends first to narrow the minute openings of the various crypts and then finally to close them altogether and so actually produce the follicles which it should be our endeavour to prevent. If the crypts contain the causative organisms, as they usually do, we have reached the stage of trench warfare. The enemy has gone to earth and, secure in his well-constructed pill boxes, can defy for long periods our thrice daily bombardment of germ-killing chemicals. It would therefore appear advisable that our irrigating fluid should also be non-astringent.

Dealing lastly with (3) we should attempt to build up the patient's resistance and this can be done most effectively by vaccine therapy. This subject is referred to later.

Most workers having tried nearly everything else have returned to potassium permanganate as their standard form of irrigation. Such being the case all experimental treatment should be based on a comparison with this disinfectant, and the most rational procedure is to contrast two groups of cases, one on potassium permanganate as a control and the other on whatever we may wish to investigate.

What forms of irrigation are left after so many have been tried? This problem was the subject of consideration by the writer in 1927-28 in Rangoon and the possibility of employing saline as an irrigating fluid was investigated in a group of cases lasting over a period of eighteen months.

As reported in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS [1] and epitomized by the *British Medical Journal* [2], reasons were given for the selection of common salt for the purposes of research. It appeared probable that its effect on the disease might be similar to that of Wright's saline in the treatment of infected war wounds, i.e., leucocytes and lymph might be caused to flow from the deep parts of the mucosa into the urethral passage and so eliminate the gonococcus. At any rate it would be non-irritating and non-astringent.

Burma Cases.

The results obtained in a limited number of controlled cases showed a considerable advantage in favour of saline. In the two groups of thirty cases on potassium permanganate at 1 : 10,000 strength and thirty on saline at 1 per cent., an average saving in hospital days of 16·9 was shown for fresh infections, and 30·9 when relapse periods were included. The total figures for the thirty cases showed a saving of 926 hospital days.

After the publication of this report observation was continued for the remainder of the time the writer was in Burma and the subsequent cases brought the total up to fifty in each group. These additional twenty cases in each group reacted much in the same way as the first thirty and the total saving of hospital days was increased to 1,605.

These figures are shown in Table A, and it is pointed out that the first thirty in each column are not new cases, but are republished in order to make a complete survey.

(Note : In each table the letter "F" denotes the presence of follicles and the letter "R" a relapse.)

Aldershot Cases.

Such were the results obtained in Burma. Would similar results be obtained elsewhere or was the success of this new treatment purely local, climatic or due to a particular strain of organism—in short, was there some factor which was not revealed ?

It was therefore a matter of interest to continue the investigation on arrival in England and find out whether the superiority of saline would be maintained under totally different conditions. Two series of investigations were therefore carried out at the Connaught Hospital, Aldershot, in 1932 to 1934.

It was originally intended to repeat the exact conditions of treatment which had prevailed in Burma, but certain factors had to be considered which led to two modifications.

The first was the strength of potassium permanganate. It was thought that 1 : 10,000 was perhaps rather too strong and that if it be as astringent as one supposes, it would be a fairer comparison to employ a weaker solution and so make it less astringent. It would probably narrow down the margin, in the event of saline again proving superior, but it would make it a more exacting test. The strength was accordingly reduced to 1 : 20,000.

The second factor which was different was the use in all cases of the Woolwich exotoxin vaccine which had not been available in Burma.

These have therefore been the only alterations made and the observations carried out in England have been on precisely the same lines as those in Burma.

It is emphasized that the Aldershot cases, like the preceding ones, were not selected, but consisted of the ordinary routine admissions placed alternately on potassium permanganate or saline.

TABLE A.—BURMA CASES.

(Length of stay in hospital in days.)

Potassium Permanganate.

Case No.	Fresh Days			Relapse Days
1	83	F.	R.	119
2	80	F.	R.	155
3	64	F.		
4	44	F.		
5	86	F.		
6	83			
7	87	F.		
8	60	F.		
9	52	F.		
10	29	F.		
11	45	F.		
12	108	F.		
13	79	F.		
14	44			
15	76	F.		
16	23	F.	R.	14
17	25	F.		
18	104	F.		
19	74	F.	R.	28
20	33	F.	R.	74
21	44	F.	R.	33
22	55	F.		
23	54	F.		
24	29		R.	33
25	29			
26	33		R.	20
27	85	F.		
28	100	F.		
29	16			
30	104	F.		
31	104			
32	58	F.	R.	41
33	63	F.	R.	130
34	60	F.	R.	65
35	56	F.	R.	66
36	92			
37	39	F.	R.	22
38	96	F.		
39	58			
40	72	F.		
41	66			
42	59	F.		
43	61	F.		
44	42		R.	24
45	135	F.	R.	22
46	116			
47	83	F.		
48	64			
49	65	F.	R.	18
50	64			
	3,281	36	16	864

Average stay of fresh cases	65·6 days
Average stay of fresh cases plus relapse cases ..	82·9 days
Total time to cure 50 cases	4,145 days

Saline.

Case No.	Fresh Days			Relapse Days
1	30	F.		
2	62	F.		
3	25			
4	76	F.		
5	31	F.		
6	56			
7	61			
8	59	F.		
9	28			
10	36	F.		
11	15			
12	91	F.		
13	25	F.		
14	53			
15	25			
16	24			
17	42			
18	20	F.		
19	17	F.	R.	13
20	19			
21	54	F.		
22	47			
23	22		R.	44
24	29	F.		
25	45	F.		
26	53			
27	47	F.		
28	118	F.		
29	58			
30	53	F.		
31	30			
32	37	F.		
33	45			
34	43	F.	R.	51
35	50			
36	41			
37	41			
38	160	F.		
39	24		R.	61
40	56			
41	26			
42	67			
43	67	F.		
44	40			
45	96	F.		
46	38			
47	59	F.		
48	17			
49	61			
50	52			
	2,371	22	4	169

Average stay of fresh cases	47·4 days
Average stay of fresh cases plus relapse cases ..	50·8 days
Total time to cure 50 cases	2,540 days

Table B.—Aldershot Cases (First Group).

(Length of stay in hospital in days.)

Potassium Permanganate.

Case No.	Fresh Days			Relapse Days
1	56	F.		
2	56			
3	54		R. R.	70 69
4	74	F.		
5	104	F.		
6	61		R.	33
7	59	F.		
8	46	F.		
9	23			
10	53	F.		
11	54	F.	R.	60
12	39			
13	59	F.		
14	51		R.	11
15	40			
16	22	F.		
17	151	F.	R.	74
18	78	F.		
19	64			
20	47			
21	28			
22	40			
23	27			
24	50	F.		
25	30			
26	66	F.		
27	84			
28	149	F.		
29	28			
30	43	F.		
31	20	F.		
32	28			
33	30	F.		
34	66	F.		
35	34			
36	83	F.		
37	63	F.		
38	50	F.		
39	63	F.		
40	24	F.		
41	50	F.		
42	53	F.		
43	36			
44	97	F.		
45	46	F.		
46	39			
47	105	F.		
48	70	F.		
49	26			
50	50	F.		
	2,769	30	6	317

Average stay of fresh cases 55·3 days
Average stay of fresh cases plus relapsed cases .. 61·7 days
Total time to cure 50 cases 3.086 days

Saline.

Case No.	Fresh Days			Relapse Days
1	54			
2	63			
3	35	F.		
4	44		R.	29
5	37			
6	37			
7	34			
8	75	F.		
9	73			
10	52			
11	47	F.		
12	101	F.		
13	35			
14	36			
15	53	F.		
16	29			
17	28			
18	29			
19	45			
20	133	F.		
21	31			
22	29			
23	37	F.	R.	40
24	38			
25	106	F.		
26	10			
27	49			
28	60			
29	96	F.		
30	94			
31	35			
32	72			
33	48			
34	71	F		
35	25			
36	73			
37	41			
38	23			
39	85	F.		
40	54		R.	38
41	31	F.		
42	32			
43	57			
44	67	F.		
45	77	F.		
46	21	F.		
47	48			
48	53			
49	36	F.		
50	89			
	2,628	16	3	107

Average stay of fresh cases 52·5 days
Average stay of fresh cases plus relapse cases .. 54·7 days
Total time to cure 50 cases 2,735 days

TABLE C.—ALDERSHOT CASES (SECOND GROUP).

(Length of stay in hospital in days.)

Potassium Permanganate.

Case No.	Fresh days				Relapse days	
1	71					
2	51	F.				
3	53					
4	32		R.		42	
5	60	F.				
6	37		R.		13	
7	28	F.				
8	34		R.		46	
9	51	F.				
10	42					
11	30		R.		28	
12	139	F.				
13	104	F.				
14	127	F.				
15	61	F.	R.		73	
16	40					
17	34					
18	42	F.				
19	77					
20	80	F.				
21	22					
22	45	F.	R.	R.	56	29
23	42					
24	32					
25	60	F.				
26	45	F.				
27	123	F.	R.		111	
28	26	F.				
29	95					
30	92	F.				
31	50	F.	R.		50	
32	107					
33	65	F.				
34	64	F.				
35	43	F.				
36	116	F.				
37	76					
38	17					
39	60					
40	56	F.				
41	53					
42	42	F.				
43	46	F.	R.		216	
44	101	F.				
45	85					
46	47					
47	42	F.				
48	40					
49	40					
50	39					
	2,964	26	10		664	

Average stay of fresh cases 59·3 days
Average stay of fresh cases plus relapse cases .. 72·5 days
Total time to cure 50 cases 3,628 days

Saline.

Case No.	Fresh days			Relapse days
1	65	F.		
2	138	F.		
3	39	F.		
4	54			
5	20			
6	59			
7	25	F.		
8	37			
9	38			
10	13			
11	26			
12	66			
13	54	F.		
14	46			
15	46			
16	57			
17	56		R.	23
18	85			
19	47			
20	51			
21	59			
22	65	F.		
23	67			
24	114			
25	42	F.		
26	27		R.	26
27	34	F.	R.	20
28	63	F.		
29	56	F.		
30	88			
31	42	F.	R.	29
32	74			
33	34	F.		
34	32			
35	48			
36	23		R.	18
37	74		R.	14
38	54			
39	18			
40	31			
41	44			
42	11			
43	100	F.		
44	46			
45	54			
46	87			
47	69	F.		
48	67			
49	98	F.		
50	41			
	2,684	15	6	130

Average stay of fresh cases 53·7 days
Average stay of fresh cases plus relapse cases .. 56·3 days
Total time to cure 50 cases 2,814 days

As is inevitable in a military hospital a number of patients do not go right through the whole of their treatment at one centre. They may have commenced treatment while on leave, they may be ordered abroad in the trooping season before they are cured, or they may be discharged to the Army Reserve. Such cases were not included. All those under review received the whole of their treatment and surveillance at the Connaught Hospital.

The first series of cases was commenced in February, 1932, and was completed in August, 1933, and is summarized in Table B.

The second series began in August, 1933, and ended in February, 1934, and is summarized in Table C.

First Group (Table B).

The fifty cases in this group showed an advantage in favour of saline but the difference was not so marked as in the Burma ones.

Comparison with Burma Cases.

(1) Saline cases : 5·1 days longer for fresh infections ; 3·9 days longer for fresh infections plus relapse.

(2) Potassium permanganate : 10·3 days less for fresh infections ; 21·2 days less for fresh infections plus relapse.

The advantage of saline over potassium permanganate was, however, maintained in each category, and in total time to cure a saving of 351 hospital days was shown. Compared with the corresponding Burma figure of 1,605 it might at first sight appear disappointing, but it was, however, still in favour of saline by a fairly wide margin and further the weaker strength of the potassium permanganate had to be taken into account.

Follicles in the potassium permanganate cases were 30, and in the saline 16. Similarly the relapses in the former were greater by 6 to 3. An interesting feature in the saline group was the relative shortness of the relapses, 35·7 days to 52·8 on potassium permanganate.

The chief points are summarized as follows :—

Saving in hospital days for fresh infections	141
Saving in hospital days for relapses	210
Total saving in hospital days	351
Number of follicle cases fewer on saline	14
Number of relapses fewer on saline	3

Second Group (Table C).

Here a slight modification was made in the saline. An interesting article by Major H. G. Winter, R.A.M.C., entitled "Notes on the Management of Venereal Diseases," published last year in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS [3] contained a reference to saline which he advocated for some of the more chronic cases. He also recommended the trial of an alkalinized saline.

In view of the well-known fact that gonococci tend to die in an alkaline medium this appeared to be a very reasonable suggestion and this group of fifty cases was accordingly placed on saline 1 per cent + sodium bicarbonate 1 per cent.

Comparison with Burma Cases.

(1) Saline cases: 6·3 days longer for fresh infections; 5·5 days longer for fresh infections plus relapse.

(2) Potassium permanganate: 6·3 days less for fresh infection; 10·4 days less for fresh infections plus relapse.

The margin was again narrowed but saline maintained its superiority over potassium permanganate in all categories. The total saving in hospital days was 814. Follicles in the potassium permanganate cases were 26 and in the saline 15. The relapses in the former were 10 compared with 6 in saline. The average for relapse periods in hospital was again markedly less in the saline cases where only 21·7 days are shown against the 66·4 for potassium permanganate.

The chief points are summarized as follows:—

Saving in hospital days for fresh infections..	280
Saving in hospital days for relapses	534
Total saving in hospital days ..	814
Number of follicle cases fewer on saline	11
Number of relapses fewer on saline	4

Comparison between the two Saline Groups.

The question whether the addition of an alkali had made any difference is answered as follows:—

Alkalinized Saline.—1·2 days longer for fresh infections; 1·6 days longer for fresh infections plus relapse; 79 more days to cure the 50 cases; 3 more cases of relapse; 1 less follicle case.

It is thus seen that the advantage rests with the pure saline but only by a narrow margin.

COMPLICATIONS.

In the first 30 of the Burma cases, as reported in the previous article, there were 7 complications on potassium permanganate and 8 on saline. In the remaining 20 no special complications occurred, except the one referred to below under the heading "Notes on the Saline."

In the Aldershot cases complications occurred as shown in Table D. This demonstrates a slight advantage in the saline cases.

It includes all complications, however mild they might be, and with the exception of a severe prostatitis following potassium permanganate treatment in the first group no case was of outstanding severity.

TABLE D.

	Potassium permanganate	Saline
(1) *First Group.*		
Arthritis	3	2
Prostatitis	5	8
Epididymitis	7	4
(2) *Second Group.*		
Arthritis	2	4
Prostatitis	3	1
Epididymitis	5	1
	25	20

SPECIAL FEATURES OF THE SALINE CASES.

The details so far given relate to the final results of treatment, but it is a matter of some interest to consider certain features during the actual course of treatment.

The first point is the rate of disappearance of the gonococci from the smears and whether it is more rapid in one form of treatment than in the other. A perusal of the Aldershot records shows that on an average the organisms disappear from the potassium permanganate cases at 15·5 days and from the saline at 14·5. Whilst there is nothing very conclusive in this it does, however, show that saline is no less effective in killing off the gonococci than is potassium permanganate; in fact it appears to be slightly more so, a point about which there was naturally considerable doubt at the outset of the investigations.

The next feature is one which should be particularly emphasized. This concerns the rate of decrease of the discharge. In saline one employs a drug with lymphogogic powers, fluid being drawn out of the deep tissues into the urethra, and so the discharge is more profuse. Potassium permanganate, on the other hand, tends to dry up the urethral mucous membrane. The difference is therefore one which would be expected, viz., for a certain period the discharge under saline treatment is far more profuse. This period is a variable one lasting from a week to about a month, but the discharge gradually decreases as the case improves. This phenomenon, in the writer's opinion, accounts very largely for the difference in results obtained by other workers who often discontinued saline as it did not appear to be doing any good. Had such cases been kept on this treatment the chances are that they would have cleared up in a comparatively short time.

A third feature is observed towards the final stages. The discharge gradually becomes smaller and smaller, the smears cease to show pus cells and the patient reports merely a "stickiness" in the mornings. This tends to persist for some little time and is apparently a continuance of the draining effect of the saline. The smears contain epithelial cells and perhaps some debris.

Here one is confronted with the problem of when to discharge such a case from hospital. The practice in these investigations has been to deal with them on precisely the same lines as the potassium permanganate cases and to wait till the case is completely dry for four days before proceeding with the test for cure. This has probably increased the length of stay in hospital of the saline cases and may have added several days to the average figures, but it has been felt desirable to play for safety.

There is therefore some possibility that a number of these cases have really cleared up some time before being allowed to leave hospital. At any rate they would appear to be more likely to be "cured" than those on potassium permanganate, and this is borne out by their fewer relapses and the shorter stay in hospital when they do relapse.

A further question remains to be asked, but owing to the average age of our Army patients is a difficult one to answer. It is this: what are the comparative chances of stricture in these two groups? The answer, however, appears to be in the form of another question: which is the more likely case to develop stricture, the one treated with a simple bland non-irritating fluid or the one with a concentrated, astringent and irritating chemical?

Notes on the Saline.

Except for the last twenty cases in the Burma figures the strength at which saline has been employed has been one per cent. In these later Burma cases it was raised to two per cent, but this did not appear to be of any particular advantage. Three per cent proved liable to cause discomfort and a five per cent used accidentally on one occasion produced a severe but temporary œdema of the penis.

At one per cent strength the solution is slightly hypertonic and although Sir Almroth Wright advocated five per cent for full lymphogogic action there seems little doubt that at the strength employed in these investigations it is definitely capable of producing a flow of lymph. This is shown by the more profuse discharge in the intermediate stages and the final "stickiness." The one per cent strength encourages the production of Nature's own antiseptic, viz. the leucocytes, and this would appear to be the explanation of the results.

The Use of Vaccines.

As explained above the Burma cases were not treated with the Woolwich exotoxin vaccine as it was not available in that country. A few cases were treated with stock vaccine, but only if they developed complications.

In the two groups of Aldershot cases exotoxin was used as a routine for all patients both on saline and on the control. The injections were given weekly and were only discontinued if the case did not appear to be progressing. A change was then made to stock gonococcal vaccine and often an improvement occurred. Similarly it has been noticed, but not quite to the same extent, that a change back to exotoxin is followed by improved results.

The exotoxin vaccine appears to be good for a number of cases, but by no means all. The stock vaccine is of undoubted value in complications such as epididymitis and arthritis.

The future treatment of gonorrhœa, whatever our irrigating fluid, seems to demand some form of assistance to the patient's immunity, which is exceedingly variable and at times apparently non-existent.

Notes on Treatment.

Irrigations have been carried out in all cases by the posterior method in order to afford thorough lavage to the entire urethra. They have been given three times daily.

No special forms of treatment apart from the irrigations have been em-employed, and the management of these cases has been largely on orthodox lines.

The one possible departure from orthodoxy has been in the passage of sounds. It was originally taught that sounds should be reserved for the later stages and that they should on no account be used before the acute stage was over. It was, however, very obvious that by this time follicles would be fully established.

The principal object of treatment by sounds is to massage the urethra and remove mechanically the organisms and pus cells which are lying in the crypts, perhaps the most important detail of accessory treatment. If this can be done successfully follicles may be prevented.

It therefore appears logical to commence sounds at an earlier time than was formerly advised, and to do so, if possible, before there is a chance of follicle formation.

Originally the custom was to wait for a fortnight. Follicles were, however, present at this period. The period was accordingly reduced to a week, and again follicles were frequently found. It became, therefore, the practice in these cases to pass sounds as early as five days from the commencement of the disease. This method has undoubtedly prevented the formation of many follicles.

It might be urged that this is much too early and that great discomfort or pain might be caused. With the average soldier this is by no means the case, and if due care be taken and the manipulation be of the gentlest kind no discomfort is experienced and no harm is done. Clutton's sounds have been used in all cases, and the size selected has been one which is smaller than that which will ultimately be used. There seems little doubt that if massage on sounds could be used sufficiently early and frequently the problem of follicle formation would be largely solved.

A further point of interest is the length of time the cases are put to bed and given milk diet. In the second group of Aldershot cases the usual period of a fortnight was reduced to seven days. It seems desirable to keep up the patient's general health and resistance as much as possible, and there is little doubt that a full fortnight on milk diet tends to lower it unduly. One's personal conclusion is that a week is sufficient time for bed and milk diet, and that the cases tend to do better once they are up and walking about and taking a full ordinary diet.

The remainder of the treatment having been mostly on stereotyped lines there is little to be said except to refer to the thrice daily administration of an alkaline mixture; barley water was given three times daily as well, and prostatic massage at weekly intervals. Kollmann's anterior dilator was also used as a routine.

Lastly, the Test for Cure may be summarized: Case four days dry; stop treatment; then prostatic massage; provocative vaccine; instillation of silver nitrate and two bottles of beer for two days. If still dry the case is then discharged to full duty with his unit.

Summary of all Cases.

The results of the experimental treatment for all cases are summarized in Table E. It will be noted that in each category the advantage rests with saline, in some categories very markedly so; for example, the number of relapses and follicles, and particularly in the total saving of hospital days, which reaches the figure of 2,770.

Table E.—Summary of All Cases on Experimental Treatment.

	Potassium permanganate	Saline
(1) Total cases	150	150
(2) Total days for fresh infections	9,014	7,683
(3) Total days for relapses	1,845	406
(4) Total for fresh cases plus relapses	10,859	8,089
(5) Average days for fresh cases	60	51·2
(6) Average days for relapses	57·6	31·2
(7) Average days for fresh cases plus relapses ..	72·39	53·8
(8) Number of relapses	32	13
(9) Number of cases with follicles	91	53
(10) Number of cases with complications.. ..	32	29

Total saving of hospital days = 2,770.

Conclusions.

In commencing these series of investigations the object was to compare two forms of treatment. The intention was neither to condemn potassium permanganate nor to favour saline. Each contrasted group of cases has received identical treatment in all other respects, and the aim throughout has been to exercise strict impartiality.

In the employment of saline no claim is made for the discovery of a new "cure" for gonorrhœa. The length of stay in hospital is too great to permit of any such suggestion.

What however is claimed, as a result of four years' investigation covering such diverse conditions as Burma and England, is that saline is a preferable alternative to the strong antiseptic of traditional teaching.

Its advantages are shown by: (1) The shorter periods spent in hospital for both fresh cases and relapse conditions; (2) the fewer number of relapses; (3) the fewer cases with follicles; (4) the total saving of hospital days.

It is considered that once the freely discharging period is over the cases clear up more quickly than on potassium permanganate.

It is finally suggested that the future treatment of gonorrhœa should depend on: (1) A bland and harmless irrigating fluid which will drain the deep tissues of the urethra; (2) early and systematic massage on sounds; (3) artificial assistance to the patient's natural immunity in the form of vaccine therapy.

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DYSENTERY AMONG TROOPS IN QUETTA.

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PART I.

(*Continued from p.* 92.)

Periodicity in Dysentery Organisms.

Dysentery in Quetta is characterized by two annual rises, one in spring (May and June) and one in late summer (August and September), with the highest incidence in August as a rule. The figures of the last six years are remarkably constant in this respect, one year only (1930) failing to show a marked drop in dysentery in July.

During the last two years, observations have been made in Quetta in order to see if the two annual rises corresponded in any way to what

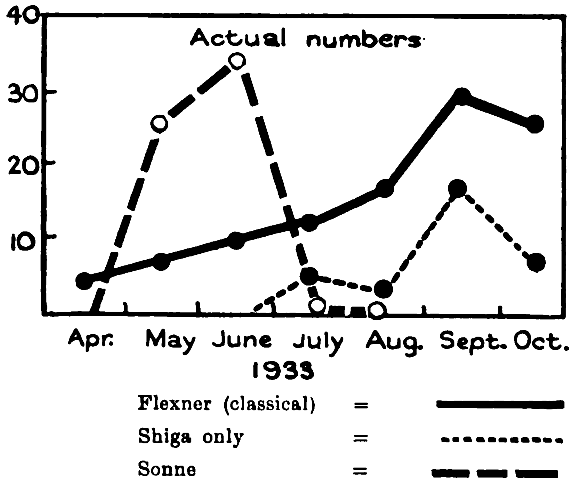

Chart 2.

appeared to be a periodicity in the case of certain organisms. They reveal that the commoner bacilli of dysentery, e.g., the classical Flexners, and also *B. dysenteriæ* Sonne and Shiga, have certain periods of increased incidence, and also periods of greatly diminished incidence, if not actual absence. The most striking example of this periodicity has been found in the case of *B. dysenteriæ* Sonne and, as can be clearly seen from Charts 1 and 2, the time when this organism is prevalent would appear to be definitely seasonal. During these two years it has been very prominent in the spring rise of dysentery, accounting actually for 45 per cent of the bacillary isolations in May and June, 1933, and about 25 per cent in April and May, 1932, while during the remainder of the two years it has occurred only in isolated instances.

A less definite seasonal periodicity was observed also in the case of the Shiga organisms and certain para-Shiga organisms believed to be pathogenic, which are the subject of research at present in Quetta. In both years they were numerically of little importance until June, when they increased notably, and remained at a relatively high level during the autumn rise of dysentery.

The number of isolations of the classical Flexners varied in a similar manner month by month during the two years under consideration. In each year the curve showing their occurrence indicates a comparatively low incidence in the spring rise of dysentery in May and June, after which they increase to become the predominant organisms in the autumn rise, and remain so until the commencement of the spring rise in the following year.

Similarly with the so-called inagglutinable Flexners, which have been recently classified by Boyd [7] so that they can no longer be called inagglutinable. Large numbers were found during 1933 in Quetta, the great majority occurring during the spring rise and comparatively few during the autumn rise.

This periodicity in incidence of dysentery organisms, if confirmed over a large number of years, would have considerable bearing on the prophylaxis of dysentery by means of a vaccine, for with our present knowledge of dysentery it is obvious that a vaccine intended to protect mainly against Shiga and the classical Flexners, would not have the same efficacy in preventing what is clinically dysentery in the spring wave of each year as it would have in the autumn wave. It is possible indeed that herein may lie an explanation for the varying accounts as to the efficacy of bilivaccin as a prophylactic agent in dysentery, apart altogether from the fact that certain organisms are definitely more prevalent in certain areas than others.

The reason for the predominance of *B. dysenteriæ* Sonne in the spring dysentery and its replacement in the autumn dysentery by the classical Flexner organisms is at present a matter for speculation only. No evidence was obtained that the spring rise was a different epidemic from the autumn rise. Neither has been confined to a certain locality, but on the contrary in each of the waves in the two years the cases have come from all over a large military cantonment. There is a marked drop in dysentery as a whole, however, between its two waves of prevalence, and it is arguable from this that the two waves in each year are really two separate epidemics.

Note on Dysentery in Children in Quetta.

Seldom a year passes in Quetta without one or two tragedies amongst the children of British officers and other ranks from this disease. As in adults, the disease is usually mild, but when the occasional severe case occurs, the child does not in some cases seem to have the resistance which in adults usually brings about recovery, so that deaths from dysentery in Quetta although rare occur more often amongst children than amongst adults.

Both bacillary and amœbic types occur among children, the latter in a very much smaller proportion than is the case in adults. This, however (as well as what follows in connection with children's dysentery), refers almost entirely to British children, for dysentery in Indian children is too infrequently referred to this laboratory for diagnosis. It is worth mentioning in passing, however, that on one occasion, very definite hæmatophagous *E. histolytica* were found in a Gurkha infant only six months old.

Although the isolation of dysentery organisms from children usually presents greater difficulty than is the case in adults, it appears that as as long as red blood corpuscles and pus cells are found in the exudate the difficulty is no greater, and the percentage of isolations from cases showing pus cells under the microscope, indicating bacillary exudate, approximates closely to that of similar cases in adults. Such cases are seldom severe in Nature, so that medical officers in attendance on children in Quetta frequently state that where it is possible to isolate the organism, the result of treatment is rapid and successful. The severe and fatal cases in children in Quetta have been those in whom an indefinite exudate was found, from which no organism could be isolated. I am unable to explain this, and merely state it as an observation. No amœbæ of any type were found in such cases.

The variations in incidence in children have been peculiar during the two years in question, for whereas in adults each year shows two rises in incidence, in children only one occurred. In 1932, the increase occurred in the autumn, and was due mainly to the Flexner and Shiga organisms prevalent at that time. There was no appreciable increase in the preceding spring. During 1933, on the other hand, the spring months showed widespread dysentery amongst children, due in the main to the Sonne bacillus then prevalent, and this was followed in the autumn by an almost complete absence of dysentery in children, as if some sort of mass immunity had been conferred on them. It will be of interest to observe what future years will show in this respect, and to see if conclusions may be drawn from what appears to be an incidence peculiar to children.

Another point of interest in dealing with children's dysentery is the means of infection, and this applies particularly to officers' children. Any one who has had experience of this disease in officers' children is aware of the extreme hygienic precautions frequently taken by the parents of such children. Every article of the carefully selected food is protected by gauze coverings from flies and dust, and a single fly in the child's room or in the cookhouse is a matter to be dealt with urgently. Yet, notwithstanding intelligent and conscientious attention to details of hygiene on the part of the mother and nurse, the child gets dysentery, and the parents are at a complete loss to explain the mode of infection. They do not know, however, whether any one of the house servants is suffering from dysentery at that moment, and it would appear that the most likely explanation lies in just such a possibility.

Epidemiological Summary.

(1) Dysentery in Quetta is characterized by two annual increases in incidence, one in May and June, and the other in August and September, with a marked lull in incidence in July.

(2) These increases in incidence are preceded by a period in each case during which (*a*) potentially irritant particles of silica are washed in excess into the water supply by rain; (*b*) frequent dust storms and dust raising winds occur. The possibility that this period may be one of increased susceptibility to dysentery as a result of the irritant action of those factors is suggested.

(3) The normal close relationship between humidity and flies and between flies and dysentery exists in Quetta as elsewhere. Flies in the barrack area however are less numerous than in other Indian cantonments and are not heavily infected with dysentery.

(4) The inference is drawn from this, and from the amount of dysentery after the flies have diminished, that infection of troops from flies is to a considerable extent indirect through the medium of missed cases who contract infection in the insanitary and fly-infested bazaar.

(5) Attention is drawn to the existence of missed cases in considerable numbers amongst children and troops, and to the possibility that much more infection than is generally realized is brought about by contact with missed cases amongst the troops themselves and amongst Indian servants in barracks and married quarters.

(6) During the two years under consideration certain organisms have shown a predilection for certain seasons of the year, e.g., *B. dysenteriæ* Sonne is prevalent in the spring months only, *B. dysenteriæ* Shiga in the autumn. The better known types of Flexner organisms are scarce in the spring and predominate in the autumn. This may have a bearing on the vaccine prophylaxis of dysentery, not only in connection with the type of vaccine to be employed, but also with the time of the year at which it is given.

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PART II.

Laboratory Notes.

A.—General Findings.

During 1932 and 1933 the number of cases examined in the laboratory was 1,536, of which 63 per cent were bacillary in origin, the remainder being amœbic or of an indefinite nature. It was not possible to isolate a dysentery organism in more than 70 per cent of the bacillary cases, so that 30 per cent of them were classed as bacillary exudate cases solely on microscopic examination of the exudate, which in bacillary dysentery, as has been so well described by Acton and Knowles [1], is almost entirely cellular.

Bacillary exudate cases in which no organism was found were regarded at first as failures, either of that liaison between wards and laboratory which ensures fresh specimens, or of laboratory technique; but a large proportion of them, if not the majority, were found on inquiry afterwards to have been old cases of dysentery, from whom it is always difficult to isolate an organism. They occurred partly in soldiers who preferred to "stick out" their dysentery rather than go sick, but chiefly amongst the servant class, gardeners, syces, personal servants and others who came under medical attention only when they were no longer able to work.

Considerable numbers were certainly due to failures in laboratory technique and such failures were almost all traceable either to the saline used to wash the mucus before plating, or to overheating the litmus lactose bile salt agar used as a culture medium. It is very easy to overheat culture media in Quetta, for owing to the height above sea-level, the ordinary steam sterilizer will not reach a temperature of 100° C., and the autoclave has to be used for all media. The margin of error permissible with this is so small that mistakes occasionally occur.

Most failures of technique, however, were attributable to the saline. It is well known that an exudate which is alkaline in reaction is more likely to yield an organism of dysentery than an acid exudate. After several failures to isolate the organism from alkaline exudates of fresh cases, it was found that the saline used for washing the mucus had become acid, so that our alkaline exudates had been artificially acidified before plating. Recently we have been titrating the saline and adjusting it to pH 8, in the hope that an alkaline saline will assist in the isolation of organisms from even the acid exudates. The results have been encouraging so far.

In order to enable the ordinary worker to make certain of the reaction, phenol-red indicator, 10 per cent of a 0·01 per cent solution, has been added to the medium in bulk so that the pH value may be read. This has not interfered with the subsequent growth of pathogenic organisms.

Faulty saline was also sometimes responsible for contaminations of the medium, which rendered isolation difficult. It is unfortunately impossible to say that saline has been efficiently sterilized just by looking at it.

Proved bacillary cases were on the whole mild but a number of severe cases occurred. Except in two, which will be mentioned later, severe cases were limited to the autumn rise of dysentery and were due to Shiga or certain para-Shiga organisms.

During the two years, 687 organisms of dysentery were isolated from cases in Quetta and they were divided by biochemical and serological tests as follows :—

Flexner Group..	.. ..	436, or 63·5 per cent
B. dysenteriæ Sonne	.. ..	97, or 14·0 ,,
,, ,, Shiga	.. ..	72, or 10·4 ,,
,, ,, para-Shiga	..	23, or 3·0 ,,
,, ,, Schmitz ..	..	39, or 5·6 ,,
,, ,, para-Schmitz	..	20, or 2·0 ,,

This does not take into account those organisms which have little if any claim to pathogenicity such as *B. alkalescens* and *B. dispar*.

A classification such as this, however, over a period of two years has very little practical bearing, for as has been shown in Part I of this report the proportion in which these organisms occur varies according to the season of the year, and this would have to be taken into account were prophylactic vaccination to be attempted.

B.—The Flexner Group of Organisms.

A very great advance was made in the serological diagnosis of this group of organisms by following the work of Boyd [2], whose study of the inagglutinable Flexner organisms has added so much to the original classification of Andrewes. Using Andrewes' classification alone, 266, or 59·1 per cent of the total Flexner-like non-lactose fermenting organisms were identified serologically with one or other of his types, while a further 116, or 25·7 per cent, were identified with the types described by Boyd.

The remaining non-lactose-fermenting inagglutinable Flexner-like organisms therefore amount to 15·1 per cent and have been further differentiated as follows :—

Indol positive dulcite fermenters, i.e. *B. alkalescens*	..	4·0 per cent
Indol negative dulcite fermenters still unclassified ..	..	2·9 ,,
Dulcite non-fermenters, still unclassified ..	..	8·2 ,,

In order to afford a comparison of these results with the results obtained by Boyd in Southern India a table has been constructed on the lines of Table IV of his article in the Journal of the Royal Army Medical Corps of October, 1932. It is to be noted that this includes *B. dysenteriæ* Sonne, and other organisms which give the biochemical reactions of *B. dysenteriæ* Flexner in twenty-four hours' growth, i.e. it refers to the mannite-fermenting group of dysentery bacilli as a whole and not only to the Flexner Group.

TABLE.

	Serological type	No. of strains	Quetta percentage	Poona percentage for comparison
Subgroup A ..	Classical Flexners ..	266	42·0	51·69
	Type P119	10	1·6	2·62
	,, 103	8	1·2	9·00
	,, 170	35	5·5	4·11
	Unclassified	37	5·8	1·12
	Total Subgroup A ..	356	56·1	68·54
Subgroup B ..	Type 88	41	6·5	7·87
	,, P288	3	0·4	3·37
	,, P274	3	0·4	1·12
	,, D1	13	2·1	0·75
	,, D19	3	0·4	—
	B. alkalescens	18	2·9	—
	Unclassified	13	2·1	—
	Total Subgroup B ..	94	14·8	13·11
Subgroup C ..	*B. dysenteriæ* Sonne ..	97	15·3	8·61
	Unclassified	87	13·8	9·74
	Total Subgroup C ..	184	29·1	18·35

Certain differences require a word of comment, but on the whole there is sufficient agreement between the two sets of figures to demonstrate the fact that Boyd's findings in South India are not inapplicable in an area as far distant as Quetta. There are two important differences however. In the first place the late lactose-fermenting organisms, and especially *B. dysenteriæ* Sonne, appear to be more numerous in Quetta, a point which is explicable probably on difference of locality. Secondly, Boyd's Flexner Type 103 appears to be much less numerous in Quetta than as shown by Boyd in Poona.

The personal factor comes in here to some extent, however, for this organism (and also type P119) is more closely related to the classical Flexners of Andrewes than the others described by Boyd. For example, Types 103 and P119 have frequently shown in this laboratory a delayed agglutination when tested on a slide with polyvalent VWXYZ serum; although no appreciable agglutination is shown by these organisms when tested by Dreyer's method on first isolation, a considerable amount of agglutinability develops on subculture, even to as much as 50 per cent of the titre of this polyvalent serum. Therefore, it is quite possible that some strains of Types 103 and P119 may have been classified with Andrewes' types in this laboratory.

There can be little question that the majority of these organisms now brought into the Flexner group by Boyd are pathogenic, for considerable numbers were isolated from clinical dysenteries in this laboratory side by side with cases showing the classical organisms of Shiga, Flexner and Sonne, and under precisely the same conditions. None were found in

several thousand normal individuals on whom tests were carried out after purgation to ascertain if they were carriers of enteric or dysentery. These organisms are moreover not entirely new to dysentery workers in India, for several attempts have been made in the past seven or eight years to classify those found by individual laboratories, none of them, however, with anything like the same completeness.

During the past year they have had a peculiar incidence for they were most common in the spring rise of dysentery when the classical Flexners were few, while in the autumn rise they were, comparatively speaking, few. For example, in May and June the ratio of the classical Flexners to those described by Boyd was as 1 is to 2, whereas in the autumn rise this was completely reversed, so that the ratio was 3 classical Flexners to 1 of Boyd's type, and later in the year, e.g. October, these disappeared altogether. It is noteworthy that this peculiar incidence has been exactly that of *B. dysenteriæ* Sonne, which was also common in the spring dysentery and practically absent in the autumn.

C.—B. Dysenteriæ Sonne.

The occurrence of this organism in the spring and its absence in the autumn has already been mentioned. During two years it formed 14 per cent of the total organisms of dysentery isolated in Quetta, i.e. ninety-seven strains were isolated. A similar percentage was found by the writer in Lahore District in 1928 (actually 13·3 per cent). Most of the infections caused by this organism were mild, but two very severe cases were noted, and a few less severe.

Case 1.—Painter Indar Singh. Loose motions with blood and mucus commenced on June 9, 1933. They became very frequent and patient became collapsed, with imperceptible pulse. *B. dysenteriæ* Sonne was isolated in practically pure culture, when stools were occurring every quarter of an hour. Patient was treated with hypertonic saline as if for cholera, and strychnine and digitalin had to be given.

Case 2.—The wife of the above case took ill at the same time with fever, vomiting and diarrhœa. This lasted two days and she died before medical attention was called. The soiled clothing was sent to the laboratory soon after death, and *B. dysenteriæ* Sonne was isolated from the mucus smeared on it.

A few severe cases also were noted.

Case 3.—Assistant Surgeon B. was working in the laboratory and dealing daily with specimens and cultures from Sonne cases. He suddenly developed a temperature of 102° F. with severe griping pains and frequent stools with blood and mucus. Motions occurred about once an hour for twenty-four hours. Frequency and pain ceased in thirty-six hours and recovery ensued. *B. dysenteriæ* Sonne was found in pure culture.

Case 4.—Cook Dhan Singh had fifteen to twenty motions a day for three days, accompanied by fever. *B. dysenteriæ* Sonne was isolated.

Cases such as these serve to illustrate the fact that *B. dysenteriæ* Sonne

in Quetta may produce a very severe and even fatal infection, in spite of the fact that the majority of the cases are very mild indeed.

B. dysenteriæ Sonne was responsible also for most of the dysentery in children during the year. It has already been mentioned that children suffered from dysentery chiefly in May and June, during which period *B. dysenteriæ* Sonne was the prevalent organism, even in adults. In children the infection was usually accompanied by fever, in some cases actually initiated by fever. Major H. G. Hobson, O.B.E., M.C., R.A.M.C., who attended most of the cases in children, informs me that on several occasions in May and June, his usual initial treatment for pyrexia, i.e. a dose of castor oil, resulted in diarrhœa with blood and mucus on the second day, and *B. dysenteriæ* Sonne was isolated from the mucus. Until the castor-oil was given there was no sign of dysentery. In such cases the fever and mucous diarrhœa lasted for two or three days and then cleared up completely.

The organism itself in Quetta showed the usual characteristics, i.e. it was an indol negative, mannite-fermenting bacillus, agglutinating to titre with stock Sonne serum obtained from the Enteric Laboratory, Kasauli, and on incubation for a time showing the characteristic late fermentation of lactose and saccharose.

Development of Roughness.—Rough variants as a rule developed very quickly from the smooth form, so that a smooth colony replated on litmus lactose bile salt agar showed in twenty-four hours about fifty per cent of rough descendants. The original colonies, however, were usually smooth, as examination of the original plates always took place within twenty-four hours of their inoculation. Should, however, examination of the original plates for any reason be delayed beyond twenty-four hours, it would also be necessary to pick off rough colonies in order to make certain that the organism was not being missed. Strains varied considerably in the time of development of roughness, some remaining smooth for several days even in a fluid medium, and a few for as long as a month. This variation in time in the development of rough colonies was associated also with a variation in time in the production of acid in lactose and saccharose media.

Development of Acidity in Lactose.—The time required for the production of acid in lactose depended on two factors in the twenty-six strains tested on this point.

(1) On the nature of the medium, i.e. whether solid or liquid.

(2) On the facility with which rough variants appeared.

Acid Production on Solid Lactose Media.—Each of the strains was plated on litmus lactose agar so as to obtain discrete colonies as widely separated as possible, and the plates were incubated and examined daily until they dried, i.e. for five or six days. The rough colonies invariably showed an acid reaction, the time of development of acidity varying from two to five days. The smooth colonies which were discrete enough to be observed by themselves did not form acid at all in the five days on which

they could be examined before drying of the plates. On occasions, certainly, the acidity from neighbouring rough colonies would spread into the area on which the smooth colony was situated, but really isolated "S" colonies were never found to have developed acidity of themselves. Colonies crowded together, however, so that their nature could not be observed, also developed acidity in two to five days, this being due probably to the "R" element in the congregation of colonies.

Acid Production in Liquid Lactose Media.—In liquid media the time for development of obvious acidity was much longer and it varied considerably. At first it was thought that the variation depended on the original reaction of the medium, and, on the suggestion of Major J. S. K. Boyd, R.A.M.C., phenol red (10 per cent of a 0·01 per cent solution) was used as an indicator instead of the usual Andradés mixture, so that the pH value could readily be judged before inoculation. The results were interesting, although they showed that with sugar of a definite pH, e.g. 7·4 or 7·6, considerable variations still occurred in the time of development of acidity in lactose and saccharose. After twenty-four hours incubation as a result of growth of the organism the pH was reduced to 7·2 or even as low as 7, thereafter alkalinity developed, increasing day by day to reach a point as high as 8, before the permanent acidity characteristic of this bacillus manifested itself. The preliminary temporarily acid trend and subsequent permanent alkalinity is of course the normal course of events with all non-lactose-fermenting intestinal organisms. In the case of *B. dysenteriæ* Sonne, however, the alkalinity of the lactose or saccharose was always succeeded by a permanent acidity of more than pH 6·6. Warning of the impending acid change in the tube was usually seen some days before in the form of a lemon-yellow tinge around the deposit, which always formed as soon as roughness developed.

Definitely smooth and definitely rough colonies were inoculated side by side into phenol-red lactose and saccharose to see if there would be any difference in the time of development of acidity between smooth and rough colonies, but while in some cases the rough colonies showed acidity two or three days before the smooth colonies, in the majority of cases no difference was observed. This is not surprising in view of the fact that most smooth colonies in a fluid medium developed rough variants in twenty-four hours' growth.

The development of acidity in these media seemed to be closely related to the development of roughness, for it was found that those strains which were late lactose fermenters (e.g. eighteen days) remained smooth considerably longer than the early lactose fermenters (e.g. five days) from which it was very difficult to obtain a smooth colony after a few days' growth.

In this series the length of time before the development of acidity in lactose and saccharose fluid media is probably longer than is normally found, because the twenty-six strains chosen for testing purposes had been in the laboratory for some months and still were capable of producing

smooth colonies. (A larger number were rejected because they had become completely rough.) That is, they were strains which tended to remain comparatively smooth and in which therefore one would expect acid development to be somewhat delayed.

In phenol-red lactose fluid medium the average time for development of acidity was twelve days, as judged by ninety tests performed for the purpose on twenty strains of which fifty-five smooth colonies and thirty-five rough colonies were tested. The shortest and longest times were one day and thirty-five days. No indication was obtained as to the reason for the differences in time shown. Tubes inoculated at the same time and from the same colony and incubated in the same way frequently showed considerable differences. It was thought that the amount of manipulation the tube received might disturb the deposit and for some reason produce acid more quickly, so twenty-one strains of smooth and rough colonies were inoculated into two sets of tubes, one of which was carefully manipulated to avoid shaking, and the other was thoroughly shaken each day. The result was that the unshaken tubes developed acid in the normal time, i.e. the average was twelve days, while the shaken tubes became acid rather earlier, the average being 9·8 days. This is not surprising because for several days before frank acidity develops in an unshaken tube, the deposit at the bottom of the tube has already changed from pink to yellow, and yet the tube as a whole appears alkaline. That is, a local acidity has developed somewhat akin to that seen when Durham's tubes are employed; the fluid in the Durham's tube frequently appears acid many days before the remainder of the fluid shows any acid change. In this case the inverted mouth of the Durham's tube is in contact with the "R" element in the deposit. Those who report this first sign of acidity naturally show a shorter time for acid production than those who wait for the medium as a whole to become acid. In this series in which the time given is twelve days, Durham's tubes were not employed, and the whole culture tube became acid in that time. I have no doubt that had Durham's tubes been employed, the time would have more nearly approached that found in the case of solid media. The explanation for the apparently more rapid development of acid on solid media is probably that the amount of alkaline solid medium affected by the growth of large numbers of acid-producing organisms congregated in a single colony, is proportionately very much smaller than in case of fluid media in which the organisms are not congregated into colonies and their acidifying action is dissipated through the bulk of the medium. The early acidification already noted in the deposit, or in the fluid of a Durham's tube, is somewhat akin to the early production of acid round a rough colony on a solid medium.

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(*To be continued.*)

THE SYMPTOM OF VERTIGO.[1]

By Surgeon-Commander J. G. DANSON, M.D., M.R.C.P., R.N.

Introductory.

Ecclesiasticus exhorts us "to let our speech be short, comprehending much in a few words." I trust that I may not ignore so venerable a dictum; and therefore, as time is short and my subject a vast one, with your permission I will go straight to the point.

I have chosen the subject of to-night's discussion, partly because it is of common interest to the Services, and partly because it has presented me personally, in my clinical capacity, with the most baffling problems that I have yet been called upon to assess. My object to-night is not to be original or epoch-making, but rather to clarify my mind; and, in the course of that process, I hope to clarify some of yours as well. In short, I propose to think aloud.

Definition.

What is vertigo? Well, the word itself implies rotation, and indeed, the symptom has been well defined as "a sensory disturbance with hallucinations of rotation, either of the patient, of his surroundings, or of both." But inasmuch as rotation is not always present, even in auditory vertigo, I prefer Russell Brain's definition, that is to say, "the sensation of a disordered orientation of the body in space." For, as he observes, "the common factor in these hallucinations is the abnormal feeling of spatial disorientation, no matter what plane they occur in" [1].

The Structures Concerned and Their Function.

I trust, gentlemen, that you will forgive me if for a few moments I take you back with me to school (I might almost say to sea), for I am about to turn my gaze on those dread gyroscopes of mal-de-mer, the cerebellum and the semicircular canals.

There exists in the mid and hind brain a whole system of ganglia, linked and connected up by the stem of the brain; that is to say, the crura cerebri, the pons and the cerebellar peduncles. In front one finds the optic thalamus, the corpora quadrigemina, the geniculate bodies, flanked by the grey corpora striata; behind is the cerebellum. In the brain stem one finds the nuclei of the oculo-motor muscles, the facial nuclei, the auditory and vestibular nuclei, and, closely adjacent to these, the nuclei of the bulb or medulla. This system of ganglia in the primitive mid and hind brain, has been thrust back in man into unconsciousness; but there

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[1] A paper read before the United Services Section of the Royal Society of Medicine, April 9, 1934, and published by permission of the Royal Society of Medicine.

is a definite suzerainty of the all-dominant and conscious cerebrum above in the regulation of the body's position in space.

All these ganglia and nuclei are *en rapport* in the most intimate manner; their interplay is easy and harmonious; they all take part in the tone and position of the body, both static and kinetic. They are all in touch, one way and another, with the ear and the eye, and with the cornua of the spinal cord. They have two sets of intermediaries between themselves and these outer structures; the red nuclei in front and the nuclei of Deiters behind. These may well be pictured as the Willesden and Clapham junctions of this ancient metropolis. For to-night's purposes we are concerned chiefly with the posterior part of this system, the cerebellum and the nucleus of Deiters, and their afferent vestibular influences.

The Cerebellum.

Co-ordination means the maintenance of muscular tone. That is essential for balance or equilibration; and, as Purves-Stewart reminds us, the cerebellum is essentially a co-ordinating centre for equilibration. "It receives its afferent impressions from the skin of those parts on which the body happens to be resting, from muscles and joints concerned in maintaining our balance, from the muscles of the head and eyes; but, most important of all, from the semicircular canals" [2] via the nucleus of Deiters. It exercises its influence on the limbs of the same side, and that influence passes through the nucleus of Deiters.

The Nucleus of Deiters.

We have seen that the vestibular nucleus, or that part of it known as Deiters, receives afferent impulses from the ear and transmits them to the cerebellum. It receives and transmits to the spinal cord, and further it has forward connexions with the oculo-motor nuclei, with the opposite nucleus of Deiters, and indeed with all adjacent nuclei. Far and away its most important connexion is the vestibular one, with impulses ascending from Scarpa's ganglion in the vestibular nerve-trunk, i.e. static impulses from the otolith, sending up messages of the head's position in space, and kinetic messages of movement from the semicircular canals.

The Vestibule, Semicircular Canals and Cochlea.

Finally, a word on this specialized nerve-ending—the labyrinth. It consists of the semicircular canals and otolith and Scarpa's ganglion on the one hand, and the auditory cochlear nerve-ending and the ganglion spirale on the other. Between them is the vestibule with the otolith. These run so far together in the eighth nerve-trunk, and part company near their entrance to the pons and medulla. The canals form a sensitive register of stability and equilibrium, and indeed of healthy harmonious comfort. If they are absent there can be no vertigo. When present their range of sensitivity varies enormously among normals. Some people get sick in a

train, or in a ship in harbour, or at the suggestion of going to sea, or even when walking from pavement to soft grass or earth. The normal labyrinth can be stimulated in health or experimentally. You are all acquainted with the rotation test for both ears together, and with the caloric and galvanic tests for each individual organ. When so stimulated the labyrinths respond by the phenomena of vertigo, nystagmus, forced movements of the head and body, and by what is called mispointing.

There are varying combinations of these, according to the strength of the stimulus and the position of the head at the time of testing. It is all a matter of reflexes. The reflex of nystagmus, for instance, reduced to its simplest form, is comparable to a flexor plantar response. If the stimulus for the latter is strong enough you get wriggling and writhing movements travelling up the trunk. If the stimulus for nystagmus is strong enough you find head inclinations, forced movements, mispointing and vertigo.

So that, gentleman, we see the semicircular canals passing on their impulses to Deiters; Deiters most profoundly impressing the cerebellum and adjacent nuclei; and they, in turn, influencing head and limbs and eyes in the matter of tone and of balance or equilibration.

Vertigo as the Physician Sees It.

With these preliminary reminders of structure and of function, the clinical study of vertigo is vastly simplified. There is a firm ground for logic to exercise itself upon. But, even so, there are many cases to challenge and defy the diagnostician. No physician forgets that Gower referred 90 per cent. of cases of vertigo to disorders of the ear; nor does he forget that there is a vertigo of the eyes. He should let no case leave his ward without an aural examination, and, in the majority of cases, an ophthalmic one as well. In any case he must examine the optic discs in all cases of vertigo.

In his general examination, the physician will note the age of his patient. In the younger he will inquire into epilepsy, migraine, disseminated sclerosis or hysteria. In the older he will think of cardiovascular lesions and arteriosclerosis. He may see evidences of neurasthenia, though his instinct makes him loathe that label as a substitute for diagnosis. As regards hysteria he will be wary, because he knows that vertigo can induce hysteria. Therefore, he excludes all other causes before he is reduced to that; and if so reduced, he looks for other indications of hysteria, e.g. deafness, loss of smell, gross anæsthesias, &c. He will be careful with the nervous system, recalling possibilities of intracranial lesions, tumours and cerebral abscesses. In these he will look for focal signs or a rise in intracranial pressure.

Congenital conditions, e.g. Friedreich's ataxia and familial vertigo, and cerebral degenerations like syringo-bulbia, will not be forgotten; nor inflammations like encephalitis lethargica and the various types of meningitis. Physiological states of vasomotor and endocrine unbalance

will run through his mind, e.g. the menopause or the climacteric; and the reflex causes of vertigo from the pelvis, bowel or bladder; and the psychical reflexes like anxiety or fear. Blood diseases, notably leukæmia, are possible sources of hæmorrhage and atrophy of labyrinthine nerve-endings. Endocrine and vegetative disorders with their varying degrees of unbalance between sympathetic and parasympathetic, e.g. Addison's disease, diabetes, or a disordered thyroid; all these will be thought of and excluded. Finally, he recalls that enormous group of toxic causes of vertigo, be they mineral, vegetable, gaseous, bacterial or metabolic.

Some Clinical Notes on these Disorders.

A word or two in passing on some of these conditions :—

Epilepsy sometimes has an aura of vertigo. If that precedes *petit mal*, unconsciousness must be established for the diagnosis. The interest of the aura lies in this: epilepsy is almost certainly a cortical brain storm; and it is now known that stimulation of the interparietal sulcus causes intense vertigo. May not this explain the cause? Again, latent epilepsy is sometimes brought to light through an acute middle ear; obviously a reflex affair and the starting trigger of fits. The use of small doses of quinine helps to diagnose between auditory vertigo and the epileptic aura. It relieves the vertigo, but not epilepsy. Migraine sometimes has an aura of vertigo, but here one notes the slow deliberate march of the aura, and the optical and sympathetic upsets. Vertigo sometimes alternates with migrainous attacks. Now migraine is almost certainly due to spasm of the cerebral vessels. We can actually see the spasms in the retinal vessels; and we believe that spasm of the internal auditory arterioles is a fruitful source of vertigo.

Cardiovascular Causes.

It is well to speak of dizziness where there is no objective stagger; giddiness, when the patient tends to fall; and to reserve vertigo for the paroxysmal manifestations. Sudden cerebral hyperæmia causes dizziness especially on stooping, for instance, over a billiard table or in tying one's shoe laces. If there is hyperpiesia or arteriosclerosis, as for instance in renal disease, that effect is enhanced. In the cerebral hyperæmia of the menopause we notice the same thing. Sudden anæmia causes giddiness as in syncope. Sometimes there is premonitory giddiness in older people, before a thrombosis or a stroke. Giddiness with headaches in atheromatous old men is always a danger sign. If there is fixation of the stapes, the local safety valve for pressure is lost in that ear, so that vascular pulsations bear direct on the sensative labyrinthine cells and make things worse. In organic heart disease, when the heart is beginning to fail, some feel giddy in the morning on rising. That indicates vasomotor failure. Some feel giddy at night when going upstairs. That is failure of the myocardium. If blood-pressure is low, as in convalescence, we see giddiness. This is also true for the blood diseases. Certain arrhythmias, like the effort

syndrome, manifest dizziness or giddiness; these may be quite severe in the higher grades of heart block—the old Stokes-Adams syndrome, for example. Again, we see it in paroxysmal tachycardia, in flutter, and in the palpitations of hyperthyroidism. A cathartic purge occasionally induces vertigo, especially in persons with some circulatory disorder.

Neurasthenics will tell you that they feel as if their legs were giving way under them, that there is a terrible thumping of the heart, a lump rising up through their chests into their throats and that they are gasping for breath. This may be menopausal or digestive; more frequently it is anxiety or fear; the fear of sudden death from what they conceive to be heart disease. They never, however, lose consciousness in these attacks.

Disseminated sclerosis is a disease of the young. Such patients complain frequently of a dizzy swaying, almost certainly pontine in origin; but sometimes they get severe and paroxysmal vertigo in the early stages; the vestibular form of onset which the French describe. These may land with the aural surgeon, in the first instance, as cases of vertigo; or they may be mistaken for hysteria. The associated signs should help however: intention tremor, absent abdominal reflex, retrobulbar neuritis or optic atrophy, or an extensor plantar response, &c., &c.

Some of the *digestive causes* (so-called) are really the effects of vertigo; acute gastric and persistent vomiting for instance. Gastro-jejunostomy has been performed before now, and even appendicectomy in such cases.

Intestinal Parasites.

Intestinal parasites may be a reflex cause, but there may be a toxic element as well. The associated eosinophilia helps one here.

Toxic Conditions.

Finally, in the group of toxic conditions: among the drugs tobacco has a high place: alcohol of course everyone knows; and among the alkaloids, quinine and salicylates are prominent. The atropine and hyoscine groups are fairly notorious; and among the minerals one should not forget chronic arsenical poisoning. Carbon monoxide is a cause also—in ordinary illuminating-gas poisoning.

The bacterial groups of toxins are legion, and so are their foci of infection: teeth, tonsils, sinuses, ears themselves, gall-bladder, appendix, colon, and *B. coli* infections. I would mention one in particular, and that is syphilis, both congenital and acquired. There is a selective action; sometimes it is the fibres of the eighth nerve, a neuritis, or again a labyrinthitis; it may be a gumma of the petrous portion or a meningeal gumma; or a fistula of the external semicircular canal. There is no pain in such cases. Other pairs of nerves may be involved, notably the third nerve. The deafness is bilateral and may come on as early as the seventh week of the disease.

Herpes zoster of cranial origin is sometimes associated with vertigo.

Any acute toxic disease can cause this symptom; I would mention mumps as a cause of severe vertigo.

Metabolic disturbance accounts for the giddiness of gout. One sees this in the hypoglycæmia following an overdose of insulin, or even in Addison's disease where the blood-sugar is also low; but, of course, the anæmia and low blood-pressure might be enough to account for it in this disease.

Aural Vertigo.

With such reflections in his mind and in his notes, and possibly some suggestive hints as well, the physician transfers the case to his aural colleague, the state of the optic disc and the Wassermann report accompanying him.

What may the otologist find? Well, he can find many obvious causes in the outer and middle ears, e.g. wax, a blocked Eustachian tube, nasopharyngeal catarrh, that most fruitful source of vertigo, middle ear disease, cholesteatomata, mastoiditis, or disease of the mastoid antrum. These are the commonplaces of his consulting room. Further, by watch and tuning fork he can test the cochlear auditory apparatus, and by means of the caloric and galvanic tests he can measure the sensitivity of the labyrinths. If he does that in all requisite dimensions he will produce some bewildering data, enough to tax the memories of the gods, let alone those of men! I remember Dundas-Grant used to help us with a mnemonic, a copy of which I always keep; but, even so, I am glad that this is exclusively the realm of the otologists. Verily "They have chosen that good part which shall not be taken away from them," at all events by me.

Now auditory vertigo has these characteristics, none of them pathognomonic, but together conclusive [1]: (*a*) There is a sense of rotation of the patient or of his surroundings. (*b*) There is diminished excitability in the semicircular canals, as shown by the caloric tests. (*c*) It is frequently associated with deafness and tinnitus—cochlear disturbance. (*d*) It is associated with nystagmus and a tendency to what is known as forced movements. (*e*) It is sometimes accompanied by diplopia. (*f*) If severe, prolonged or paroxysmal, there will be pallor, sweating, disturbance of the pulse-rate and pressure, nausea and vomiting. (*g*) Very rarely there is loss of consciousness. (*h*) In labyrinthine lesions the occiput is tilted towards the shoulder of the affected side.

The matter, however, is not so simple and clear cut as this. The signs are often atypical. Sometimes there is little loss of sensitivity, as indicated by the tests. Occasionally unconsciousness occurs (Russell Brain). Sometimes the auditory symptoms are wanting. Both labyrinths may be affected in a varying degree, and so on. An acute inflammation of the middle ear can modify labyrinthine sensibility to the various tests. Moreover, there are differences in the responses to caloric tests in different diseases. Asymmetry between the conditions of the two ears, and the resulting heterogenous stimuli should never be lost sight of.

On this matter hear Scott [4]. He finds that lack of patency of the Eustachian tubes and invagination of the tympana, unequal on the two sides, a most fruitful cause. If both tubes are equally inefficient, and both tympana equally depressed, one finds deafness but not vertigo. If, however, one side is worse than the other one finds severe vertigo and the deafness is not noticed. He attributes many defective air landings and many fatal spins to this cause, because vertigo in the air is associated with reflex forced movements. In consequence, a pilot with a blocked Eustachian tube thinks he is landing on an even keel when in reality one wing is dipping very noticeably. He says that all pilots should be able to inflate both Eustachian tubes by swallowing or Valsalva, or else give up high altitude flying. The same thing occurs with sailors in submarines and with divers in high atmospheric pressures.

Scott records the case of a lady with early otosclerosis in one ear, who suddenly got intense vertigo in a shop. She was thought to be tipsy and sent home in a cab. He tried to inflate the bad ear. Matters did not improve. When he inflated the Eustachian tube on the sound side she got well almost at once. That tube had become temporarily blocked.

Spasm of the tensor tympani or stapedius can cause vertigo by disturbing the stapes. When the stapedius is at fault the facial muscles may twitch and quiver.

A number of troublesome cases occur with old chronic otitis media, or where a mastoid operation has been done and everything seems quite well. They are subject, after a time, to giddiness which is accentuated by walking on a narrow plank or on going aloft. I had such a case. He was sent in to hospital as a seaman who refused to go aloft. After exhaustive collaborration between the aural surgeon and myself, we could find no special reason for his giddiness beyond a long standing chronic bilateral otitis media, now dry. He was sent back to his ship after reassurance, and with the alternative of changing his rating if he did not succeed in going aloft. He declined to do either, and was sent back to hospital and finally invalided. At the time I thought he was trying to get out of the Service, but I have since read in the literature of many such cases; and it appears that they are genuine enough.

From all this we see that the auditory vertigo is most commonly produced, not by disease in the labyrinth itself, but by stimulation from the neighbourhood without. It may be inflammatory, or a matter of pressures, or of hyperæmia or ischæmia; it may be a reflex phenomenon.

The Ménière Syndrome.

But suppose no demonstrable lesion is found, and the vertigo is severe and definitely auditory in type, then the semicircular canals are suspect; the labyrinth, the cochlea or both; and the otologist has to ask himself what is going on in that bony petrous invisible fastness; or again, is the lesion behind the petrous bone, that is to say is it central or peripheral? The

answer is not always easy. He now finds himself in that perplexing maze known as the Ménière syndrome. Two things may help to clear his mind at the onset: (*a*) He can compare the labyrinth, which is an invisible and inward nerve ending, with the outward and visible signs of the retina and optic discs. For instance he can ask himself "Is there such a thing as glaucoma or papillœdema in the labyrinth?"—A rise of endolymph tension? It is plausible. Why not? The intravenous drainage system from the vestibule is more intimate with the intracranial circulation than is even that of the retina. Again, is there a labyrinthine equivalent of tobacco amblyopia? He notices that spasm occurs in the migrainous retinal vessels. Why not then in the arterioles of the internal auditory vessels? (*b*) He must be struck (indeed he has good reason to be) by the gross vegetative or sympathetic upsets so manifest in severe vertigo. Portmann [5] of Bordeaux has experimented freely on the question of spasm and stasis of the labyrinthine vessels, by vasoconstrictors and dilators; by pressure upon the vertebral vessels and common carotid; by section of the cervical sympathetic; and by pericarotid sympatheticotomy. He finds that paroxysmal vertigo can be produced either by stasis and œdema or by angiospasm and ischæmia in the cochlear and vestibular branches of the auditory vessel; the first producing hyposensitivity and the latter hypersensitivity in the labyrinthine cells; and this he compares ingeniously and somewhat convincingly with the digital ischæmia of Raynaud's disease. Either extreme of sensitivity may induce vertigo.

The Original Ménière Case, which I have taken the trouble to look up, came to autopsy; and it was found to be a plastic lymph exudate, which Scott [4] has convinced himself was a serous meningitis due to acute infective labyrinthitis, where the drum had not perforated. Before Ménière had found that vertigo originated in the labyrinth itself, the symptom was always looked on as a forerunner of apoplexy.

Hæmorrhage.

Hæmorrhages as a cause are very rare. Fraser [6] has found one or two old organized hæmorrhages in cases of leukæmia, and of course we can surmise small hæmorrhages after concussion. In that connexion one should mention those traumatic cases of persistent cerebral contusion, so usual nowadays after motor-car accidents, with giddiness and headache and loss of concentration and general irritability.

Grading of Ménière's Syndrome.

Ménière's syndrome in its acutest form consists of paroxysms of vertigo of the auditory type, giddiness, reeling, deafness, and tinnitus, with bulbar and sympathetic phenomena, nausea, vomiting, cardiac and pressure changes and cold clammy sweat. The attacks strike the patient down suddenly in a paroxysmal manner; but he is not unconscious. He falls away from the side of the affected ear. Nystagmus, even diplopia, may be

seen whilst the paroxysm lasts. Headache and vomiting may persist for some time after the attack. The complete paroxysm is very rare. In practice we see modified editions of the syndrome. Fraser [6] divides it into three degrees :—

(*a*) Apoplectiform, with total deafness at the onset and loss of vestibular function on the side of the lesion. Causes : hæmorrhage, purulent labyrinthitis, mumps.

(*b*) Sudden onset, but not complete loss of vestibular response. Causes : toxic neuritis, herpes, glaucoma.

(*c*) A gradual onset. Causes : cerebral arteriosclerosis, tumours of the eighth nerve, acquired syphilis, occasionally otosclerosis. Some of the latter cases may have only a transient giddiness with a tendency to recur. There may be some deafness and tinnitus between the attacks.

As a general rule the vertigo of cerebral lesions is less severe than that in the labyrinth itself. It may be exceptionally severe or very slight in cerebellar abscesses, depending entirely on their position in that organ. Any tumour may present vertigo as a symptom, but it is commoner in tumours of the posterior fossa. Tumours in the cerebello-pontine angle may present some nasty attacks, but they are not so sudden or paroxysmal as, say, that of labyrinthitis proper. Further, they are accompanied with tinnitus and deafness. In vascular cerebral lesion a thrombosis will cause paroxysmal vertigo, whilst in local arteriosclerosis the onset is gradual. A focal lesion affecting Deiters' nucleus would cause paroxysmal vertigo with facial pains due to its proximity to the fifth nerve nucleus and its roots.

Differential Diagnosis between General and Peripheral Vertigo.

I regret I have no time, in a survey of this character, to go into the differences between central and peripheral lesions. Generally speaking, central lesions present focal signs, and later, a rise of intracranial pressure. One finds ocular signs, insensitive cornea, crossed anæsthesias or crossed pareses, hemiataxias and the like, and possibly optic neuritis, together with deafness, tinnitus and vertigo in a varying degree, and nystagmus.

Dundas-Grant advises careful readings with the galvanic tests rather than the caloric, when central lesions, so called, are suspected.

Ocular Vertigo.

As I have already remarked, some cases of vertigo are ocular in origin. How then can we distinguish auditory from ocular vertigo? Well, in the first place, the usual causes of ocular vertigo are (*a*) low degree of astigmatism, (*b*) a strabismus of paralytic type with false projection of the visual fields and diplopia, (*c*) anomalies of muscle balance-heterophoria. Now, shutting of the affected eye in a paralytic strabismus will stop

vertigo. Indeed, the simplest test is to open and close the eyes. If vertigo is present when the eyes are open and not when closed, the vertigo is ocular, not aural. Take the example of the superior rectus muscle. I know of such a case which took months before it was fully tracked down. The patient had to keep his eyes open and look up to obtain the diplopia tendency. If he kept his eyes closed, the vertigo resulting from his diplopia disappeared. If he looked upwards with the sound eye closed, a very unpleasant sensation of false projection was experienced. Objects in the upper field were displaced too far up.

The ophthalmic surgeon must first discover the diplopia which occurs on looking up and then decide which eye is affected. In aural vertigo the patient has vertigo when looking straight ahead, which a patient with a paresed ocular muscle never has. Moreover, diplopia is rare in aural cases. " Then one notes in the aural case the jerky movements of objects, a distinct erroneous projection in the direction of the object, so that if the patient tries to touch it his hand goes too far in the direction of the object-mispointing, and also associated tinnitus " [7].

Finally a word on treatment.

TREATMENT OF VERTIGO.

The first maxim is treat the cause; that is if you can find it, which I think I have shown you is sometimes more easily said than done. Take auditory peripheral vertigo first. Luminal is the drug *par excellence*, $\frac{1}{2}$ to 1 gr. t.d.s. Larger doses can be given subcutaneously during an attack. I believe alcoholic injections have been tried in very severe cases; and recently Cairns and Brain [1] have had marked success on five cases by section of the auditory nerve. In Eustachian cases inflate by catheter. Some use bougies. Tweedie[3] has used small doses of iodides (1 or 2 gr. t.d.s.) very successfully when inflation or dilatation was not permanent in its effect. In some cases small doses of quinine are very effective. In concussion cases $\frac{1}{96}$ of a gr. of perchloride of mercury will relieve severe tinnitus and vertigo. Amyl nitrite may give relief in the giddiness of arteriosclerosis. Iodides are the real sheet anchor in that disease. In the neurotic cases bromides give relief. Then there is the whole group of vaso-dilators and vaso-constrictors. Adrenalin can be used locally or internally, the nitrites, e.g. mannitol and the like, can be used internally. The belladonna group is useful in seasickness; and so on.

In all cases look to the nasopharynx and nasal passages, the sinuses, the tonsils, and the teeth. An x-ray may show an offending unerupted wisdom tooth which is causing vertigo reflexly. Various operations can be done on the outer and middle ear. Wax can be removed. In acute cases fenestration of the tympanic membrane can be performed. The ossicles, if fixed, can be removed. Mastoid operations are constantly being performed. Pericarotid sympatheticotomy may be helpful in angiospasm. In

central cases, where tumour or abscess is diagnosed, intracranial surgery must be resorted to. There is a class of cases where neuropathic treatment is essential for success. I remember one such case so cured, who, when congratulated on the result by his friends, promptly went deaf. Lumbar puncture does good in certain cases, especially if the lateral or pontine cisterns are under pressure. Uncapping the external canal and draining the labyrinth by catgut has been successful in Peter's hands.

CONCLUSION.

In conclusion, Mr. President and Gentlemen, vertigo is a sensory expression of disordered function, produced in so many ways from such a variety of afferent impulses, all bearing on the labyrinth, that I make no apology for the broad acres of medicine I have had to traverse to-night in this very rapid and, I fear, superficial survey.

The immediate stimuli, both reflex and direct, would appear to be in the nature of hypo- or hypersensitivity in the affected labyrinth, the result of varying pressures, either circulatory or inflammatory, resulting in tension changes in the labyrinthine perilymph and endolymph. Stasis of the arterioles or spasm of these vessels determines the onset of vertigo and tinnitus and deafness in a large class of cases. Lesions of the middle ear and Eustachian tubes are a fruitful source of trouble. Asymmetry, both ears being affected in varying degree, should always be considered. The labyrinth is sometimes the direct cause of the disorder and sometimes incidental in this disorder.

Only by a sound knowledge of structure and function, and by close co-operation between the physician, especially the neurologist, and the aural surgeon, is there a reasonable hope of success.

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Editorial.

ACTIVE IMMUNIZATION AGAINST DIPHTHERIA.

OBSERVATIONS upon the epidemiology and immunology of diphtheria have been carried out by Surgeon-Captain S. F. Dudley and his colleagues at the Greenwich Hospital School for twelve years. In the first seven years, though the Schick test was permitted, active immunization was not practised at the School and the studies were therefore carried out under natural conditions. In 1928 the School authorities accepted inoculation against diphtheria, and this afforded an opportunity for a close comparison of natural immunity, acquired by a community in which diphtheria was endemic, with a condition of immunity artificially produced by inoculation in an institution which had been maintained over ninety per cent Schick immune for five years. The parallel series of observations was made on a community living under conditions otherwise identical.

Surgeon-Captain Dudley and his colleagues state that the conclusions arrived at from the records of this School are not necessarily valid for the community at large. The variables in this School are known, but are infinite in variety in the general community. Further, the conditions obtaining in one semi-isolated community may be different from those in another. Nevertheless, certain broad principles emerge which, with some reservations, may become generally applicable.

With the artificial immunization of the School in 1928 clinically recognizable diphtheria practically disappeared, but in the winter of 1932 an outbreak of modified diphtheria led to the investigation with which the report, just issued by the Medical Research Council, deals.

New entrants to Greenwich Hospital School, aged 12 to 14 years, were segregated for a month in a separate building and grounds before joining up with the rest of the School. During this period they were swabbed and Schick-tested. On the seventh day the Schick immunity was recorded and those boys who were Schick-positive received their first prophylactic inoculation, followed by a second dose fourteen days later; three weeks later a second Schick test was performed and, if positive, a further dose was given. The population of the School remained very steady. The number of beds was 980 up to the end of the year 1930. In contrast to the steady population the number of new boys who joined in each term varied from 51 to 162. The new entrants in most terms joined in two batches, one at the commencement of the term, another one month later. The average term was three months, and new entrants were exposed to infection prevailing in the main school for half their first term. Practically

all the residents stayed for seven terms; some for three years, and a few for over four years.

Prior to 1924 most of the diphtheria was concentrated in two epidemics of 61 and 67 cases in the first term of 1919 and the third term of 1921. After 1924 the incidence became less periodic and more evenly distributed in time.

An attempt was made to evaluate statistically the apparent decline in the susceptibility of groups who, having joined the School in the inter-epidemic periods, were subsequently exposed to the same risks of infection as groups who joined during the epidemic periods. The figures gave support to the general inference that many of the boys who entered the School during the inter-epidemic periods acquired immunity latently, so that they were able to pass through the subsequent epidemics with fewer diphtheria casualties than the boys who joined when the epidemic was in progress. Herd-susceptibility to clinical diphtheria may decline without symptoms of sore throat as an environmental and not as an age or growth phenomenon—demonstrating the principle of latent immunization without using the Schick test. The mechanism of latent immunization is still undetermined, but the evidence supports the view that antitoxin will appear as the result of stimulus from its homologous toxin, which is supplied by virulent *Corynebacterium diphtheriæ* carrier infection.

The incidence of diphtheria in the artificially protected school is of great interest. After the School had been inoculated against diphtheria in March, 1928, nineteen cases of diphtheria were discovered up to December, 1931. In March, 1933, an indefinite case was reported in a boy who had been immunized in 1929: his Schick immunity had relapsed and *C. diphtheriæ* (var. *mitis*) was recovered from his throat. No further cases were reported until October, 1932, when eighteen cases occurred in that year and five more cases in the first term of 1933, the last prior to the removal of the School from London. The outbreak of eighteen cases in October and November, 1932, coincided with the introduction of the Leeds serological *gravis* type of toxigenic *C. diphtheriæ* and a carrier rate which was higher than any recorded prior to the artificial immunization of the School. Further, nine-tenths of the carrier rate was made up of Leeds *gravis* strains, which were responsible for sixteen out of the eighteen cases in 1932, and for all five cases in the following term in 1933. None of the cases were severe and eighteen out of the twenty-three cases would not have been recognized as "clinical" diphtheria. The temperature was high, the typical false membrane was not formed except in the cases naturally Schick susceptible. The majority of the cases had less than 0·05 unit of antitoxin per cubic centimetre of blood, whereas carriers showed the highest antitoxin content of the groups tested.

At first the workers at the School thought these unrecognizable cases of diphtheria were not real cases of diphtheria, but further observations led to the view that they were not suffering from simple sore throats accom-

panied by an accidental carrier infection of *C. diphtheriæ*. The reasons for this view were: (1) That the outbreak coincided with the appearance of typical Leeds *gravis* strain in the School; (2) the majority of the cases had less than 0·05 unit of antitoxin per cubic centimetre of blood; (3) the highest incidence of diphtheria was in those groups which showed the least antitoxin protection; (4) the clinical severity was inversely proportional to the antitoxin protection; (5) the antitoxin estimations showed that infection, clinical or sub-clinical, caused a rapid rise in the circulatory antitoxin, which was coincident with the onset of clinical symptoms, viz. the symptoms had not arisen in a subject who had been infected with *C. diphtheriæ* some days before going sick.

Dudley states that the study of this series of diphtheria cases in relation to the antitoxin estimations of the blood shows that diphtheria in a subject who has once been Schick-negative, but who has lost his antitoxic immunity, acts as a secondary stimulus causing a rapid recovery of antitoxin and a trivial illness, whereas in the original susceptible who has never been immune diphtheria is followed by no appreciable rise in antitoxin and a severe clinical syndrome.

In the discussion on some general principles of active immunization against diphtheria reference is made to Glenny and Jensen's experiments which seemed to show that antitoxin in the blood is not acquired gradually but remains low until one of the prophylactic inoculations acts as a secondary stimulus, causing a rapid rise in a few days, after which there is a fall and the antitoxin content settles down to a semi-permanent level. Contrary to the experimental evidence field workers found that when using the toxin-antitoxin mixture it might take six months for seventy per cent of those inoculated to develop Schick immunity. With the advent of good toxoids it is now known that ninety per cent of subjects develop Schick immunity within a month of their third inoculation. With weak courses in the past many subjects remained Schick susceptible until they met a secondary stimulus in the form of toxigenic *C. diphtheriæ* in their environment and then became Schick immune. In this way the frequency of Schick immunes continued to increase for six months or more after the T.A.T. courses.

The work at Greenwich showed that while anti-diphtheria inoculations are a sure protection against clinically recognizable diphtheria, they convey no immunity against latent or carrier infection with toxigenic *C. diphtheriæ*. This is a most important observation as it implies that while artificial immunization protects the individual it does not prevent him from becoming a potential danger to the susceptible members of his herd.

A fact of paramount importance in regard to diphtheria control for practical purposes, is that all carriers of virulent diphtheria bacilli give negative Schick reactions. Schick susceptibility in a carrier of virulent bacilli is of such a short duration that Schick-susceptible virulent carriers may be ignored. The procedure of isolation and virulence testing of a

Schick-positive child, even though diphtheria bacilli have been discovered in his throat, is regarded as uneconomical as a public health measure.

The Schick test depends on antitoxic immunity only: it is not surprising therefore that the prophylactic, which is designed to stimulate antitoxic immunity, should have no power to prevent infection with specific diphtheria bacilli.

Very variable estimates have been made as to whether diphtheria carriers cause more fresh infections than do cases. It seems probable that in towns where diphtheria is endemic infection from carriers, rather than cases, is more frequent than in country epidemics, where case to case infection appears to occur more often. All field-workers, however, are agreed that carriers outnumber cases to such an extent that any diminution of diphtheria patients which results from active immunization is unlikely, by itself, to reduce appreciably the reservoir of toxigenic diphtheria infection.

The experience at Greenwich suggested that the rapid transference of Schick susceptibles into Schick immunes by artificial immunization would augment the carrier rate for virulent diphtheria bacilli, and would increase the morbidity among the unprotected members of the herd. It is, therefore, probable that the incomplete artificial immunization of a group may have no effect on the total incidence of diphtheria and for a short period may increase the risk of attack in the unprotected section of the community.

The experience in schools is instructive from this point of view. Ross McKinnon immunized a third of the school children in Toronto, but none of the pre-school age group: there was no decline in the diphtheria morbidity though the incidence in the inoculated fell eighty per cent. At Hamilton, Fitzgerald found that diphtheria disappeared when a large fraction of the *pre-school* and school children had been protected. Godfrey has shown that when a large proportion of the children under the age of 5 are maintained Schick immune, but not till then, the diphtheria incidence will fall rapidly and will practically disappear.

Dudley considers that the production of virulent carriers by artificial immunization is another example of how an undesired effect frequently results when man tries to improve his biological environment by upsetting the ecological balance between two species, in the present instance *H. sapiens* and *C. diphtheriæ*. Nevertheless, he is confident that provided an anti-diphtheria campaign is conducted in a proper way, recognizable diphtheria can be generally eradicated from any community. He and his colleagues made the deduction that three doses of diphtheria toxoid can produce in three months as high an immunity as three years' residence in a community where diphtheria is endemic.

It has often been assumed by the anti-diphtheria worker that the Schick reaction is practically permanent. But at the Greenwich School there were 55 immunity relapses ; 45, including 6 cases of diphtheria, had been artificial immunes, and 10, including one case of diphtheria, had

been natural immunes. Further studies showed the ratio of artificial immunes to natural immune relapses was 12·6 to 3·5. There seems to be no doubt that the maintenance of a Schick-negative state in a certain section of the community depends on frequent reinforcement of their antitoxic immunity by environmental stimuli. Such a relapsing type of Schick negatives is more likely to be found among artificial immunes than among natural immunes.

The bulk of the relapses could not be attributed to the employment of prophylactics of lower potency than usual. The one weak antigen employed demonstrated that although a weak antigen may produce nearly as much immediate Schick immunity as a strong one, yet in order to avoid relapses the antigen should be as strong as practicable.

Relapses were more frequent after Schick immunity had been induced by one or two doses of prophylactic than after three or more. But at Greenwich the relapse rate depended far more on subsequent environmental stimuli, or the hereditary make-up of the individual, than on the number of prophylactic inoculations.

Another factor which affects the subsequent Schick susceptibility is the time relation between the last dose of the prophylactic course and the post-inoculation Schick test which is used to prove that immunity has been induced. Glenny and Südmersen in experimental animals and Jensen in children have shown that the curve of the titre of diphtheria antitoxin in the blood rises very rapidly after one or other of the doses of prophylactic. After rapidly reaching a maximum in ten to thirty days it falls at first quickly, then more gradually and then approaches a permanent level of antitoxin concentration. If this permanent concentration is above the Schick level the Schick test will remain negative indefinitely; if below, after a transitory period of Schick-negatives the test again becomes positive. But after secondary stimuli in places where there is a high but *intermittent* risk of infection with *C. diphtheriæ* the antitoxin titre may rise again and no association will be discovered between the relapse rate and the time of the post-inoculation test.

The ideal of the public health administration would be immunization by means of one inoculation, and this Jensen has realized, but the extra time, material and expense involved in the manufacture of concentrated toxoids renders one-dose immunization hardly an economic proposition for mass immunization at the present time. Nevertheless, the experience with alum toxoids by Saunders in this country, and by Wells, Graham, and Havens in America, seems to point to single inoculation being within sight for herd protection against diphtheria.

As to the interval between prophylactic inoculations, the Ministry of Health recommended doses of one cubic centimetre on three occasions with fortnightly intervals. But Glenny's work seems to show that better immunization is obtained, especially as regards durability, if one of the inoculations acts as a "secondary stimulus." In subjects who have had

no primary antigenic stimuli from environment the first injection is a "primary stimulus," and the subject does not obviously respond until after a latent period of five to ten weeks, and even then the response is often trivial. But the subject is now "sensitized" and will give a rapid and generous response to a second dose of toxoid which acts as a "secondary stimulus." On these principles it seems better to give the second and third inoculations of the prophylactic course five and ten weeks after the first inoculation instead of after the usual two and four weeks. The matter is, however, largely one of expediency because intervals longer than a fortnight are said to increase administrative difficulties.

The Ministry of Health instructions state that the post-inoculation Schick test should not be made for at least two months after the last immunizing dose. Dudley thinks it would be better to postpone the test for at least three months, instead of making it after one month, as was done in the Greenwich School; the titre drops rapidly from its initial maximum value, which occurs within a month of the last injection, and there is therefore a distinct risk of finding Schick reactions negative after an interval of a month, which will become positive again in a few weeks.

Dudley states that observations on diphtheria in inoculated subjects show that, *provided it is known that the Schick test has once been negative*, relapses of Schick or antitoxic immunity are really of little consequence. Although subjects may have lost their antitoxic immunity, they still possess a greatly augmented immunizability and rapidly regain Schick immunity on contact with a toxigenic *C. diphtheriæ*, generally latently and without symptoms. But in that minority who get diphtheria the sore throat and constitutional symptoms are usually so trivial that they would not be recognized as diphtheria without a complete bacteriological examination. Such cases would be almost invariably missed in general practice.

In Graham Forbes' exhaustive summaries of anti-diphtheria campaigns throughout the world there are frequent reports of high diphtheria morbidities among the unprotected, accompanied by practically no cases among the inoculated members of the community.

Dudley concludes that while it is of supreme importance in preventive work to make certain that Schick immunity has followed the prophylactic course, the maintenance of *permanent* Schick negativeness is of less importance than has been generally believed. He stresses the importance of protecting children in the pre-school age-groups 1 to 5, and recommends that in a household all children under 15 should be immunized together. In certain circumstances he also advocates the immunization of children under 12 months old, as he considers the convention that they should not be immunized does not stand on a firm scientific basis. In some epidemics it has seemed possible that the incidence and fatality in the 0 to 1 age-group has been increased as the direct result of the immunization of the older children. In such circumstances it appears hardly justifiable to withhold the toxoid from the newly born. The main objection to the

inoculation of the infant is that owing to skin insensitiveness it is relatively irresponsive to antigenic stimuli. It has been suggested that skin insensitiveness to toxin is an immunity index to clinical diphtheria irrespective of the presence of antitoxin in the blood. It used to be thought that the infant's immunity was due to antitoxin derived from the mother, via the placenta, but Okell has shown that Schick-immune infants may have less than 0·002 unit of antitoxin per cubic centimetre of blood, and that the infantile negative Schick test usually persists for six months or more after the maternal antitoxin has disappeared from the blood. The problem of protecting the 0-1 age-group bristles with difficulties, and requires more investigation before an opinion can be given on the subject. In the Ministry of Health pamphlet the immunization of this group is not recommended.

Clinical and other Notes.

REPORT ON A CASE OF HEPATIC ABSCESS WITH SPONTANEOUS EVACUATION THROUGH THE RIGHT LUNG AND BRONCHIAL TREE.

By Major E. P. N. CREAGH,
Royal Army Medical Corps.

This case is considered worth recording as it presents unusual features and demonstrates the great assistance rendered by X-rays in diagnosing and following the progress of events in similar cases.

The patient was a Serjeant in the Royal Artillery, aged 37, of temperate habits. He had spent the last four and a half years of his service in India. Excepting uncomplicated left lobar pneumonia in 1931 he had enjoyed excellent health during his nineteen years' service. He had never suffered from dysentery.

In October 1933, while still on duty, he suffered from vague malaise and anorexia for a week and had a coated tongue; he was then admitted to hospital. He ran a remittent temperature for thirteen days and complained of ill-defined epigastric pain to the right of the mid line. Physical signs were absent and all investigations negative. He had on one occasion a leucocyte count of 11,700. There was no satisfactory explanation of this illness. He was discharged apparently well at the end of twenty-three days. He remained well until January, 1934, when he was admitted for the illness about to be described. For some days before admission he had felt just as he had done during his previous admission.

For the first six days his temperature remained steady in the region of 102° F. He had absolute anorexia, a muddy complexion and thickly coated tongue. He did not complain of any pain. There were no physical signs or symptoms suggestive of hepatitis until the sixth day when breath sounds were diminished in the right pulmonary base and there was impaired resonance, and tactile and vocal fremitus were diminished over this area. There was no evidence of malaria nor of enteric group infection. A leucocyte count on the third day gave a total of 11,200 with 68 per cent neutrophils.

A teleradiogram of the chest taken on the third day showed the right dome of the diaphragm raised $1\frac{1}{4}$ inches above the left. Screening confirmed this but showed the respiratory excursion to be quite normal.

There was no downward enlargement and absolutely no pain or tenderness referable to the liver.

A second teleradiogram (fig. 1) on the seventh day showed a relative rise of $1\frac{3}{4}$ inches, an increase of $\frac{1}{2}$ inch in three days; the leucocyte count was

11,000 with 71 per cent neutrophils. A tentative diagnosis of amœbic hepatitis was made and emetine therapy initiated forthwith. During the next eight days he received daily 1 grain of emetine intramuscularly.

Response was unsatisfactory, pyrexia continued, the temperature only remitting between 101·5° and 100·5° F. He said, however, that he felt slightly better daily. During the last three days of emetine treatment the temperature dropped by lysis to normal and there was a definite general improvement. The leucocyte count was 9,000.

A third teleradiogram taken on the twelfth day (sixth day of emetine) showed a relative drop of ¼ inch.

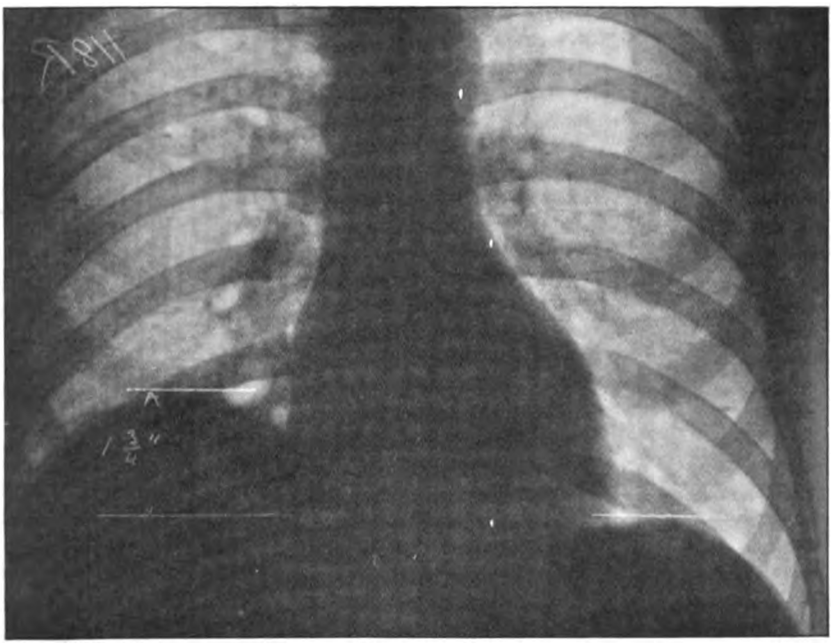


FIG. 1.—Taken on January 29, 1934 (seventh day).

It was then felt that the diagnosis was probably correct and that the case would pursue the usual satisfactory course of amœbic hepatitis treated in the presuppurative stage.

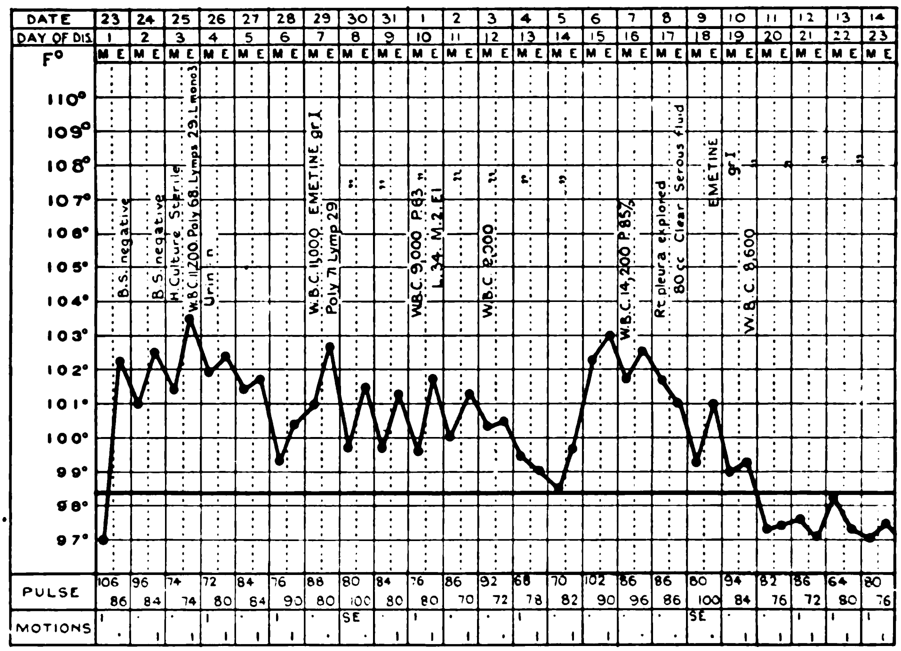
However, this was not to be. On the evening of the fourteenth day (eighth day of emetine) the temperature rose, he became very distressed by a paroxysmal cough without expectoration and severe pain in the right lower chest and subcostal region.

Next morning he presented a typical picture of right diaphragmatic pleurisy. Severe pain, short suppressed paroxysmal cough, limitation of movement, guarding of the upper quadrant of the right rectus and a loud pleuritic friction rub over the base of the lung. His leucocyte count was

14,200. He was kept under the influence of morphia for the next forty-eight hours. By the evening of the sixteenth day he was coughing up muco-purulent sputum with a definite "anchovy" tinge.

A fourth teleradiogram was taken on the sixteenth day and showed a relative rise of 1⅝ inches on the right and superimposed on the upper margin of the diaphragm a circumscribed kidney-shaped opacity slightly more transradiant than the diaphragm-liver shadow below.

It seemed certain that an abscess had worked through the diaphragm and parietal pleura and was becoming adherent to the visceral pleura. Hoping to aspirate this and thus avoid evacuation through the lung I



explored the right pleura through the tenth interspace in the line of the scapular angle, about 3½ inches in a forward, inward and slightly downward direction. A clear, straw-coloured effusion was encountered and eighty cubic centimetres were withdrawn by gentle aspiration. Further efforts to tap the track of the pus caused great pain and were immediately abandoned. By that evening the patient was coughing up moderate amounts of obvious liver pus and continued to do so for forty-eight hours, never in large quantities and not more than three ounces in all. Microscopically the pus swarmed with all manner of organisms, contained degenerated liver cells, but no amœbæ were seen. His general condition immediately improved, the temperature fell by lysis, and he was convalescent with a normal total leucocyte count by the twentieth day.

From this time onward convalescence was uninterrupted. A teleradiogram showed the satisfactory subsidence of the liver and resolution of pleuritic effusion. Another course of emetine and stovarsol was administered. When seen fourteen days after discharge from hospital he had gained eleven pounds in weight and was feeling very well (see fig. 2). There were no physical signs in the right base.

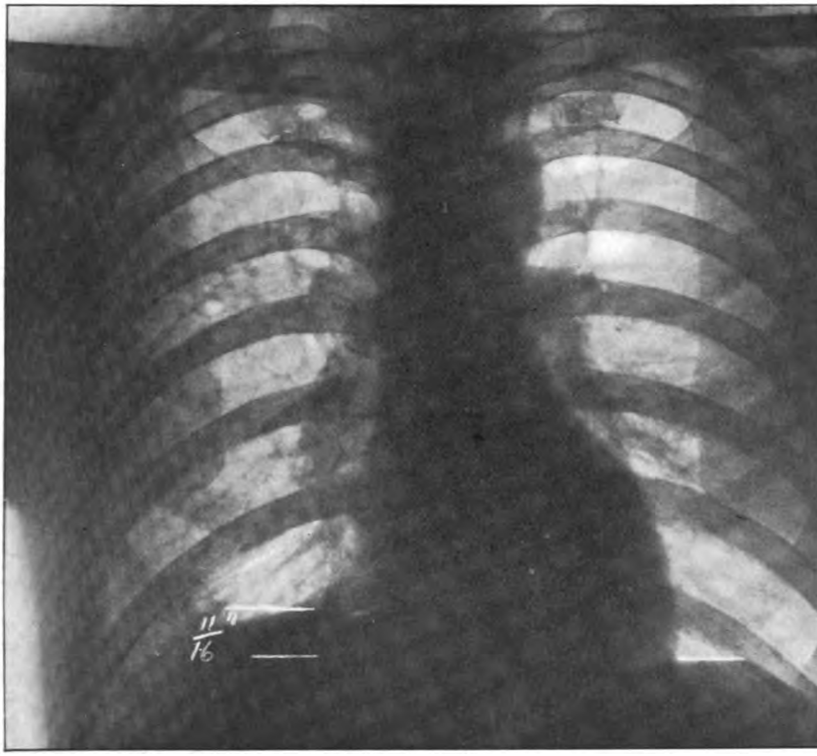


Fig. 2.—Taken fourteen days after discharge from hospital.

Commentary.

The interesting features of the case are as follows :—

(1) The complete absence of any symptoms referable to the liver until immediately before rupture of the abscess through the diaphragm and pleura.

(2) The fact that the respiratory excursion of the diaphragm on the right was quite normal at the beginning of treatment and that suppuration evidently took place while the patient was actually under treatment with emetine.

(3) That such a small abscess should have taken this route of evacuation.

(4) The pus from the liver abscess caused a minimal disturbance by its passage through the lung. As soon as the pus had been evacuated the respiratory symptoms cleared up immediately.

(5) Nature's effectual method of sealing off the remainder of the pleural cavity by a localized effusion.

The fact that the patient did not give a history of dysentery is so usual in these cases as hardly to require comment.

A differential count of the more immature forms of neutrophil leucocyte would have been of interest in this case but was unfortunately not done.

In another recent case of acute hepatitis a differential polymorph. count showed 6·3 per cent metamyelocytes and 5·3 per cent band forms. The diagnosis being confirmed by X-rays and by the response to treatment.

The response to treatment in these cases is so gratifying that every method of early diagnosis becomes of especial interest. In the last year there have been eight cases of hepatitis treated in this hospital, and in every one of these the X-rays has been of the greatest assistance.

I have much pleasure in thanking Major H. Rice, M.C., I.M.S., Specialist in Radiology and Assistant Surgeon J. M. Linford, I.M.D., for their assistance and collaboration, and Lieutenant-Colonel A. E. S. Irvine, D.S.O., R.A.M.C., Commanding the Connaught Military Hospital, India, for permission to forward these notes with a view to publication.

A CASE OF GLOMERULO-NEPHRITIS.

BY MAJOR C. SCALES, M.C.,
Royal Army Medical Corps.

THE chief interest of the case about to be described lies in the remarkable absence of symptoms and clinical signs, the fatal termination and the post-mortem findings. The patient, a well-nourished young Pathan, aged 18 (two years' service), reported sick on July 2, 1933, complaining of bilateral subcostal pain. He had a "drunken" appearance, a foul breath and a coated tongue. Purgatives were administered and there was a marked improvement, so much so that after being detained for forty-eight hours he was discharged to duty on July 4. Later that day he reported sick again, complaining of the same pain and some difficulty in breathing. He was admitted to hospital for observation.

Previous History.—No illnesses during his two years' Army service. He had done full duty up to July 2. His parents are alive and are agriculturists, and prior to enlistment the patient ate the usual food (meat twice a week).

Condition on Admission.—Temperature normal. Gait unsteady and "drunken" but no Rombergism. Knee-jerks +. Pupils equal, reacted to light and accommodation, moderately dilated (discs not examined).

He was constipated, tongue furred, breath foul. Examination of

thoracic and abdominal cavities revealed nothing abnormal with the exception of slightly laboured and deep respirations. The patient appeared to suffer from air hunger. At 17.00 hours on July 4, the patient became restless and had difficulty in breathing. He was conscious but cerebration was slow. He did not complain of pain.

Early on the morning of July 5, the patient sank into a condition of semi-consciousness, groaning and turning his eyes when spoken to. He became unconscious and died at 08.10 hours.

At no time was there any definite odour in the breath. There is no record of urine examination after his admission on July 4, but a note that when detained on July 2 his urine was free from albumin.

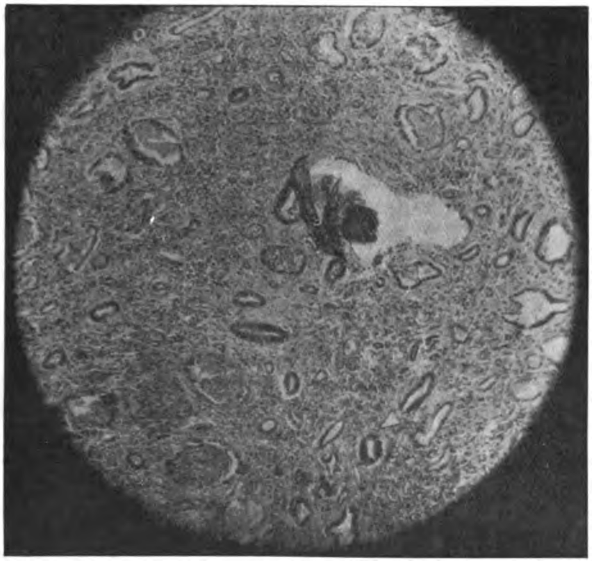


FIG. 1.—Section of right kidney. $\frac{1}{6}$.

Post-mortem Findings (on July 5).—No signs of external injury, well nourished, rigor mortis slight. Post-mortem staining over shoulders and buttocks.

Thoracic cavity: Old adhesions in both pleural cavities. Lungs healthy.

Heart: No valvular lesions. Coronary arteries patent. No sign of pulmonary embolism. Aorta healthy. Left ventricle contained no blood or clot. Walls of left ventricle definitely hypertrophied.

Abdominal cavity. Liver: Weight three pounds. Smooth, firm, cut edges everted. Liver substance congested. Microscopical: A very definite early interlobular cirrhosis with round-celled infiltration of portal tracts. The liver cells appear healthy. At the periphery of the lobules the columns of cells are separated by red blood-cells. No sign of any obstruction or inflammation of bile ducts or cystic ducts.

Spleen: Weight 7½ ounces. Firm, no change.

Kidneys: Considerable difficulty was met in freeing the kidneys as they were firmly bound to surrounding tissues. Both organs were much distorted.

Right kidney: Weight 2 ounces, atrophic and distorted, capsule adherent, surface granular. On opening the organ, marked naked-eye changes were seen; marked fibrosis; differentiation between cortex and medulla obliterated; arteries prominent. Microscopical: A diffuse and dense fibrosis, numerous areas of intense lymphocytic infiltrations. Vessels markedly hypertrophied, in some cases the lumen practically obliterated. The tubules showed marked atrophy of lining epithelium; many of the tubules were greatly dilated, containing coagulated protein. In some fields this dilatation was so marked as to give a multilocular cystic appearance. The glomeruli showed various stages of inflammation, early sclerotic change,

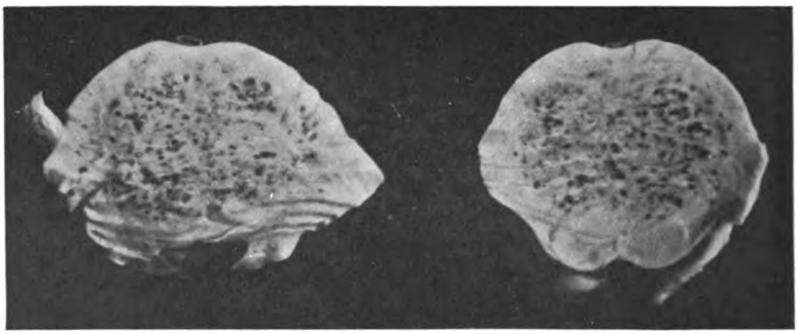


Fig. 2.—Macroscopic appearance of pons.

and a few places of total destruction. The appearances were those of a chronic diffuse glomerulo-nephritis (fig. 1).

Left kidney: 3½ ounces. Similar changes, though less advanced than in right kidney.

Bladder: distended. Urine drawn off, opaque, alkaline. Albumin + + +, pus cells +, a few red blood-cells and many renal epithelial cells.

Brain: Meninges adherent to cerebral cortex. No macroscopic changes in cerebrum or cerebellum.

Pons: Innumerable hæmorrhages found throughout. Serial sections showed these hæmorrhages were confined to the pons and did not extend into either medulla or crura (fig. 2).

The immediate cause of death would appear to be due to pontine hæmorrhage following upon uræmia, the result of a chronic diffuse glomerulo-nephritis.

In connexion with the pontine hæmorrhages it is interesting to note that although the patient's gait was affected, at no time was any Rombergism noted, nor did he fall over when pushed. This points to damage or interference with the vestibular centre or tracts in the pons.

The sensory and motor tracts and centres were not involved nor was there any interference with muscle sense and co-ordination. The diagnostic symptoms and signs of pontine hæmorrhage were absent, i.e., alternated paralyses, ocular palsies, pyrexia and contracted pupils.

The existence of such advanced renal lesions without any interference in the patient's routine Army life is very remarkable. Careful inquiry elicits no history of any acute nephritis or œdema.

Travel.

BEYOND LEH.

A SHOOTING TRIP IN LADAKH, 1926.

Being a Diary kept by

K. W. DICKSON, F.R.G.S.

(*Continued from p.* 134.)

XXIX.—Below the Pass at Khemhar.

Thursday, 15th July: We woke to find the sun shining on the snows, a perfect morning, the air so clear and balmy after the rain. We dressed hurriedly, with more zest than usual, and got away immediately after breakfast, the two coolies following with the gun and the small rifle, as the shikari said there were lots of marmots on the way to our next camp.

The path was the steepest ascent we had done so far, although not the most difficult, and three days' rain on fallen leaves made it very slippery. We were both shod with grass sandals but even they had no grip of the ground.

No Sahib had crossed by this route this year; the other route joined our path further on.

Our baggage followed several hours later as the tents had to be pitched in open ground in the sun to dry before they could be carried up.

The shade of the trees was pleasant as we were very warm with the exertion of climbing. Emerging from the forest the view was perfect, great sloping pasture land above us sheltered by a semicircle of snow hills; and almost directly below—so steep had been our ascent—lay the Sind valley with its white foaming river, little hamlets and walnut trees.

Our track wound downhill for about two miles towards our next resting place, over snow-filled gullies which alone would have made the road impossible for ponies. The snow was so soft that even we had difficulty in crossing, and R. unintentionally tobogganed down one gully.

We left the last of the birches behind and I found all sorts of new flowers; wild marsh mallows and saxifrage ligulata, and anemones as thick

as daisies on a lawn, where the snow had melted, but nothing green was to be seen.

There were just enough tiny pieces of wood lying about, from last year's fires probably, for us to make a fire and make our coffee. After lunch the coolies were glad to rest, and we started off on a round of the lower hills looking for marmots, but not one did we see.

There was a frozen lake, a clear emerald colour, at the top of the far valley. We crossed over the top of the ridge dividing twin valleys to get back to our camp. From the higher ground we got a glimpse of another partly frozen lake only five or six hundred yards from the camping ground, but hidden by a rise. Here was a natural rock garden, covered with saxifrage in bloom, and abounding with many varieties of rock plants.

Suddenly there was a shrill whistle and we took cover; then R. went forward with the gun and got that marmot. There were many about quite near the lake but they darted into their holes if we made any movement at all. I left R. to continue the hunt and went on to show the shikari where we wanted the tents pitched, and to give the khansamah flour for drop scones for tea. He made them as soon as the fire was kindled, and served them hot, and there were none left over.

The tents were pitched on turf near a stream, but higher up the snow had just melted, and the ground was a dark colour like peat. Grass was just beginning to appear but pale yellow anemones and blue gentian were everywhere; the gentian was a wonderful colour.

The colouring of the landscape was like one of those coloured prints I have seen of the Alps, so clear cut, and the sky so blue.

I loved Ladakh, but there was something very satisfying about this scented air.

XXX.—Zekwas: In the West Lidar Valley.

R. spent the following morning from seven until eleven o'clock hunting marmots, but although he saw quite a lot, he got none. The baggage got away about nine, as soon as the tents were dry enough to carry; there had been a heavy dew overnight. To get into the sunshine, I climbed to the top of a ridge and sat on a rock. There was a fine view to the north, and I looked down on the lake. The ice and water were a hard chalky colour against the fresh green of the pasture. I got glimpses of R. across the valley occasionally.

The coolies and servants wandered up a zig-zag path and disappeared over the hill, and then to my astonishment I saw a line of men slowly mounting up what looked like the face of the cliff just above me.

R. came shortly afterwards and we started off for the pass. It was indeed what it looked like, the face of a cliff, but there was a track slanting across some ground between rocks; this was covered with soft snow and was very slippery, the sun being well up. We climbed and climbed, pausing often for breath. The feet of the man ahead of me were on a level with

my face, and yet I could have touched his feet with my hand. Two coolies had been sent to cut steps in the snow further up, and going was easier then. The last part was in a chimney with soft snow filling the middle; we got foothold in mud and rock on one side. It was a fearsome view that we got all the way up, straight down into the frozen lake. At some of the halts for breath we did not dare look down.

It was pleasant to find a small plateau at the top, even although it was covered with several feet of snow. R. took a photograph of us all; the line of coolies, servants and dogs.

The descent was an easy slope, snow for half a mile, and afterwards dark wet ground, where gentian and primula rosa grew abundantly. Here I gathered some wild rhubarb quite near where the snow lay.

FIG. 29.—Top of Khemhar Pass, 13,500 feet. Sind Valley to Lidar.

There was a good deal of climbing over boulders before we reached the valley. The pass we had climbed was 13,500 feet, and we had come down about 2,000 feet, we guessed, when we passed several small pools of stagnant water. In India one is always looking for mosquito larvæ, and here they were sure enough even at this altitude.

We had tiffin beside some rocks where the coolies could get a sheltered spot to make a fire. All around the ground was covered with the rose-coloured primulas, and I picked a bunch for our camp table. They have a delicate scent which reminds me of narcissus, but more especially just of spring at home. That is what we miss in India—spring. We jump from our pleasant Punjab cold weather into summer by the middle of March,

and we never smell spring coming as we do at home. In Kashmir there is a real spring.

We camped about four miles down the stream, and decided to stay for a day or two, as there appeared to be lots of marmots.

Next day R. followed up a tributary of the West Lidar, and I spent the morning up the hillside writing letters, with the dogs beside me. I had prepared lunch in the tiffin basket and went off with the tiffin coolie about eleven o'clock up the river where R. had gone. It was a perfect day, blue sky and white snow above and green grass below, and birds singing everywhere.

R. returned in the evening with four marmots. It had been so lovely that I was tempted to take sketching things and spend the day out, so I started next morning after getting R.'s lunch ready and seeing him start back up the valley towards the Khemhar pass. I had just got settled and had sketched in the hills in charcoal, when down came the rain. Quite a big river had to be crossed to get back to camp. The tiffin coolie usually carried me when I was going out, but returning I walked through the stream as I could get dry stockings at once. That day the current was tremendous and the water was well above my knees, and I had to change more than my stockings! It was safer to keep one's eye on the far bank and feel for safe foothold, otherwise the rushing water beneath is apt to make one feel giddy and overbalance.

It rained all that afternoon and all the next day. We emptied our dining tent, storing the yakdans in our bathroom, and let the coolies sleep in the tent. They had been sleeping behind rocks and must have been very cold indeed. The temperature dropped considerably after the rain came. Everything in the tent felt damp and it was difficult to keep warm. I, who had kept perfectly fit through all the cold weather in Ladakh, got a nasty chill, and in spite of an opium pill hardly slept that night.

R. had got only one marmot that day and he was very anxious to get enough to make a rug, so next morning he went off in the rain, but got none. It is very boring sitting in a tent when it rains. I wrote more letters, and had quite a budget ready to post when we got to Pahlgam.

I had breakfast in bed next day and didn't get up until the sun was on the tent, which was about eight o'clock; not really late, but it seemed late for us. I took out the Kashmiri flower book and verified some of the new varieties. I saw the tiny purple anemone first at Zekwas; the hillsides were covered with it.

Two Sahibs passed on the path from Khemhar while I was sitting in the tent; the shikari said they were going to camp further down the river.

XXXI.—Lidarwat.

July 21st. R. had one more try with the gun before we started for Lidarwat. I kept Garry for company and one tiffin coolie to light a fire and carry the basket. Many families of Kashmiris with ponies, dogs, and

flocks and herds passed up the valley while I waited. A man brought a child which he said was ill and asked me for medicine. It looked very under-nourished and had an enormous head. I told him to bring it to the Sahib later. Then a mother brought a tiny baby which she said was a year old. I understood what was wrong with it and gave her some medicine. I first tried to persuade her to wait for two hours to see the Doctor Sahib, but she pointed to the sky where clouds were gathering and held up the black cloth sling which was all she had to cover the baby.

Many of these wandering folk come from beyond the Pir Punjal, the range which separates Kashmir from India, and I found quite a few of them spoke a little Hindustani, or at least understood it.

R. had shot two marmots, but both had fallen down into their holes and could not be recovered. We crossed the river, the tiffin coolie carrying me, although I forded many streams on foot later in the day. I thought it better not to start out with wet feet, but I had no fear of catching a chill while we were marching ; it was sitting in the tent that was so trying.

We had tiffin on the hillside, and then R. went up another valley while I sat and wrote up the diary. Garry meantime burrowed for either field mice or lizards, I don't think he knew which. R. came back sooner than I expected with one marmot, and we started for Lidarwat, a seven mile march. It was the first time we had done an afternoon trek, and we thoroughly enjoyed it, making tea by the riverside, and arriving in camp in time for bath and dinner. It was a lovely march. We had a good many streams to ford, and it was impossible to get across dry, but as we were wearing quilted felt boots and grass shoes we didn't mind. The valley closed in after the first two or three miles but it was always beautiful. Pine forest rising steeply on one side and pasture land on the other. There was still a certain amount of snow in the gullies, and in some places there were snow bridges across the stream, but these were just ready to fall in.

We reached Lidarwat and found our camp just as a heavy storm broke; however it passed over quickly.

The shikari came to our tent after dinner and plans were discussed for the morrow. He had got word that there was a side valley about eight miles away where marmot abounded, so we decided to stay two days at Lidarwat, to give R. what seemed to be a very last chance. We had eleven marmot skins at that time; not quite enough to make a rug. I thought I would go part of the way with R. and see Kolahoi, the Matterhorn of Kashmir. Between that peak and its twin peaks there is a glacier.

We were late in getting to bed and had made no preparations for next day's tiffin, and found at breakfast that the scones were almost finished and there was no cold meat, so we hastily got eggs boiled and divided the scones, which were tiny; R. got two boiled eggs and two scones and a piece of cheese, and I got one egg, one scone, and cheese. There was no time to prepare coffee or fill the thermos. We were away before seven up a winding path through dense pine forest, then open glades with a rushing tumbling dancing river coming down between big rocks on our right.

About four miles up the marmot nullah opened off this valley and this was the parting of our ways. I had taken a pony, thinking I would go only a little way up to see Kolahoi, but having gone so far, I determined to go right up to the glacier if it were possible. We had to ford six streams, and there was so much water that my legs were wet well above the ankles even when riding. I didn't like to tuck them up too far in case I overbalanced and got a ducking.

We passed many encampments of these nomad shepherds, dirty untidy people, very unlike the Ladakhis. Ladakhis may be dirty, but their children are well cared for, and they are not slovenly as these people are. The children, even the tiniest tots, ran out crying, "pice, pice," as I passed. I never carried any money, so they got none. Our khansamah remarked about these gypsy shepherds that they were so dirty it was no wonder they were ill.

There was a fine waterfall about half way up; a tremendous volume of water coming down. I terrified the tiffin coolie who accompanied me by climbing down a bank of soft shale to get a photograph. He followed me down, and when it came to climbing up, I was glad of his help as the shale was so soft I made no headway until he put his stick horizontally in the ground for me to tread on. Probably he felt very responsible, seeing I was out on my own. He and the pony man stopped to get a drink from a very dirty woman at a turf hut. I sat on a rock and watched a man on the far side of the stream who was carrying a sheep on his back with its legs round his neck. To my surprise he put it in the river and gave it a very thorough bath. Then I saw the women folk further up washing another sheep; it took two of them to hold it. It seemed a primitive way of doing it after having watched a "dipping" on a big sheep farm at home. I passed a big flock a few minutes later and I counted fourteen very lame sheep and lambs in the rear. The tiffin coolie told me these shepherds get fourpence a head a month for tending sheep, and the same for goats. It sounds very little, but a family may look after as many as two or three hundred, which might bring them in £5. Their food would cost them only threepence or fourpence a day; their milk supply is unlimited, and they have no rent or taxes!

As we topped a rise a large white tent came into view, a Sahib's camp. It was funny to see a washing hung out to dry in that lonely spot. The tent was much larger than any we had and looked very comfortable.

We were now within a few hundred yards of the base of the mountain, the West Lidar river flowing out of the mouth of the glacier. I began to think that if I climbed up the hillside to the left I would get a much better view in better perspective, so up I went. The pony came as far as possible; then I dismounted and followed a goat track on foot. It was well worth the climb! There was a magnificent view of all the peaks with the glacier between them. Kolahoi towered far above the hills around. At first I did not realize the size of the glacier, the lower part was so heaped with

moraine, but I understood when I saw the river coming out of the great mouth beneath it. This mass of moraine filled that part of the valley, and higher up must have been hundreds of feet deep; then came obvious snow all chopped up and standing in pinnacles, and still higher, smooth looking snow with terraces of blue ice glistening in the sunshine. These terraces rose one above another; it was a fine sight. I was very sorry I had not brought a telescope. I took several photographs, trying different size of aperture and exposure for the same view in case the light was too strong. They all seemed to come out equally well when developed later.

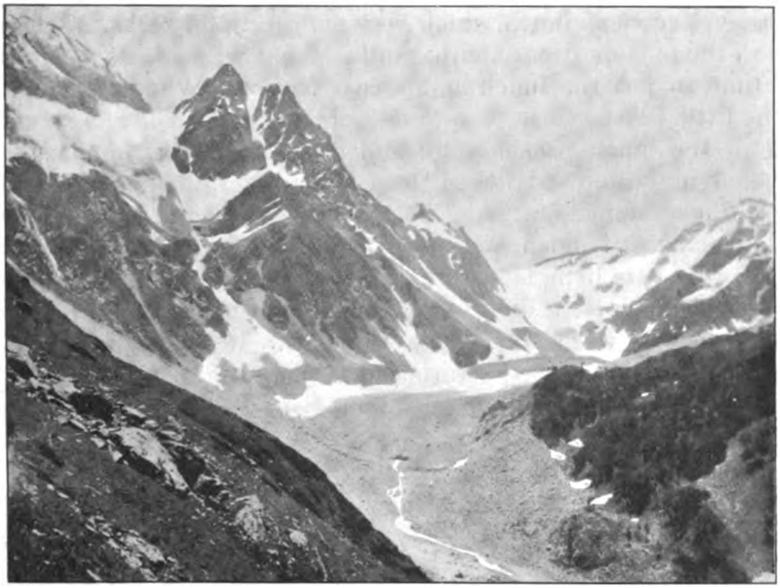


FIG. 30.—Kolahoi. The twin peaks, showing the source of the West Lidar river in the glacier.

Then I ate my tiny lunch with a large appetite; I at least had plenty to drink, as a stream rushed down a little gully quite near me, coming from under a bed of snow above, so I did not think there was any risk of the water being contaminated.

A man with a large flock of sheep came up the way we had come. He and the tiffin coolie sat and chatted away below me, the sheep wandering up the hill in long lines. They looked so peaceful and made such a nice picture, I took another photograph of them, but it did not turn out well.

We went down the valley much faster than we came up. I had no watch, but from looking at the sun I surmised it must have been about half past two when I passed the entrance to R.'s nullah. I was far too hungry to wait for him, so went straight back to camp. It was past four when I got there so I had tea at once under a big pine tree, with a dog on each side. I got a great welcome after being away all day.

It did not seem likely that R. would be back for another two hours and he would be both tired and hungry, so I sent the pony back for him with the little thermos filled with tea. He was very glad of both. He brought back four fine marmot skins. Fifteen skins seemed big enough for a rug ; at least, as R. said, big enough to cover one person. He had climbed about a lot amongst rocks and snow and his face was very burnt. He had seen a great number of marmots, but there was so much snow it was often difficult to get near them. While he sat waiting for one to reappear, a tiny grey animal peeped out of a hole and after a few preliminaries, snuffing with its little nose in the air, it gathered courage and went straight to the little paper parcel of lunch which was lying on the rocks. After it had licked all the outside paper and began to tear it with its claws, R. thought it was time to put the lunch in his coat pocket. When he moved to do this, the little beast ran back into its hole, but not for long. It came and sniffed for the lunch packet again and after searching the place where it had been lying, came and licked the tunic pocket, making the cloth quite wet ; then it scratched quite angrily. R. put out a hand and gently stroked its fur, which was longish and soft and downy, and to his surprise it did not run away. Its little feet were like a marmot's, the paws covered with soft fur, but otherwise it did not resemble a marmot at all. The head was too pointed and it was a soft dove-grey colour. It must have been a young stone marten of the Tibetan variety. I had seen a tiny one among the rocks at Chuma-tang, but I only got a momentary glimpse of it.

XXXII.—The Final Marches.

The march to Aru was delightful, through shady glades with the river on our right and high pineclad hills on either side. The turf was so springy and the flowers and the pines smelled so good, it was sheer joy to be on the road. The dogs leaped over each other with pure delight.

It was such a nice pony I had going up to Kolahoi that I asked for it again, although it was such a short march.

We had been going steadily downhill for the last two marches, and R. said at this rate we would soon be below sea-level. Aru, our next halt, was about 9,000 feet, and our plan was to follow the river down as far as Islamabad. There were plenty of sites for camps at Aru, and very attractive ones too. We kept to the edge of a ridge under a clump of pines overlooking the valley towards Pahlgam. We got all the wind that blew, and we needed it, as we felt the heat, coming suddenly from that cold spell at Zekwas.

Aru was such an ideal spot that I was surprised to find no other camp there. It was an open valley, perfect turf, a natural golf course, not too high, with good water and wood in plenty. There was a tiny hamlet where milk and eggs could be bought and it was only one march above Pahlgam.

Our oatmeal had come to an end, but we were enjoying stewed rhubarb and cream, after our eggs for breakfast every morning. I picked some

mushrooms near the camp. I thought they were mushrooms; R. said he didn't know, but the Kashmiri boy said he knew, and had tried them with a two anna bit to see if they turned it black. So we risked it and enjoyed them very much, and suffered no ill-results.

I was loth to leave Aru next morning. It was so pretty and so peaceful. Our route lay through the village, about eight or ten houses roughly made of wood with sloping projecting roofs and verandahs. They were rather like the Dalecarlian houses in Sweden, but not nearly so well built.

Our next stage was to Pahlgam, a beautiful path again, but we were feeling somewhat depressed at getting back to civilization and nearing the end of our trek. It was warm that day. We saw a nice sheltered spot by the river and I had a quick bathe; the water was icy cold, but it was very refreshing.

We saw several men fishing, and then rounding a bend we met Major and Mrs. Scott, whom we used to know in Lahore. They were going fishing a mile or two further up. They were camping with their family at Pahlgam. We could see many tents in the distance as we neared the village; then near the bridge was an ayah and a Sahib's baby; this was indeed a civilized place.

We chose a site for our camp on the ridge across the river, then went straight to the little bazaar, and in quite a spacious shop R. had a small bottle of beer. He had been talking about it for some time past. There we got cigarettes and sweets, sugar almonds were my choice, and also a few necessities, like soap. People who have never had to do without soap cannot appreciate our pleasure at getting a nice big cake of Pears' soap for our baths again.

I asked at the Post Office for a list of visitors to see if there were any people we knew, but we knew none of the names.

It was very hot and sultry, obviously a thunderstorm was not far off. We had done some repacking and had settled down to read the papers I had bought, when we noticed some Indians looking at a site for a camp not 20 yards below us. We thought at first that they were Sahibs' servants, but in half an hour a family of Indians arrived, two men and two women, and then three or four children. If some of the people who talk about fraternity with our Aryan brothers had been in our tent that night, they would undoubtedly have changed their minds. Our stream of drinking water was polluted before our eyes; children squabbled, and men in very easy undress lay on native bedsteads basking in the sun. If we had stayed even one day more at Pahlgam, we should certainly have changed our camping ground. There were several permanent camps quite near, people who stayed for two months, and I felt sorry for young mothers with children having undesirable neighbours like these.

Motor cars passed along the main road while we sat having dinner outside. We had not seen a car since the middle of April, and it seemed strange to see them so near a lonely little place like Aru.

It was still very hot and sultry when we left about seven o'clock next morning. The Kashmiri policeman had come round the night before to put our names on the register, and he told us that the police patrolled the camp twice during the night. We heard them some hours later blowing their whistles, as R. said to warn any thieves that might be about.

My feet soon became very sore walking on this hard motor road after the soft bridle paths of Kashmir and the sandy ways of Ladakh. I had a blistered heel and I could have shaken the shikari for saying we had only six miles to go when the six miles lengthened out into nine. It was extremely hot and sultry and we did not enjoy that march.

We camped on a bit of meadow land above a canal. Here we had lots of mosquitoes and sand flies as well as ordinary house flies. We had no mosquito nets with us, so smeared our faces with cold cream and covered them up as best we could before we went to sleep.

The shikari had got "khubar" (news) from a village the night before that a black bear had been seen in an apricot tree close at hand. So in the evening R. went up the hill to watch the gully where it had come down the previous night but he did not see it. A thunderstorm was passing over and it rained heavily so "Mr. Baloo" probably stayed at home. We waited another day, in spite of mosquitoes, to see if he would come down the following night.

We had a dish of delightful stewed fruit that night; a crimson "blackberry" that grew on the cliffs by the roadside. They tasted more like raspberries, but the bushes had long trailing branches like English blackberries. Whatever they were, they were delicious to eat.

We had a late breakfast and a good slack next morning. One of the servants climbed a tree and got us some wild apricots, which were too sour to eat raw, but were very good when cooked.

My feet had recovered somewhat by afternoon, so before five o'clock we started up the hill, the other side of the gully this time, to look for the bear. It was a steep climb, but not really long. We sat perfectly still on open ground where we could see if anything came over the hill and down the gully. We sat from half past five until past eight o'clock but no bear appeared. I was very disappointed as this was the first time I had gone out with R. after bear, and I had the gun loaded with lethal bullets, and was to have first shot. It was very pleasant sitting in the scented evening air, the level valley stretching away far down to our right. After the thunderstorm there was a great deal of water lying about in the fields, which reflected the evening sky. But after sundown, which was the time we really expected the bear, and nothing happened, I got rather disheartened. It seemed to be our very last chance, only one more night in tents, and then Islamabad and a motor lorry to Srinagar. We unloaded the guns and started for home. It was quite dark when we got back to the camp for dinner. The dogs heard us a long way off and gave us a great welcome.

The servants tried to get us a tonga, a native pony cart, to take us to our next stage about eleven miles away, but we had to be content with two tiny riding ponies which would not even trot, but as I said, I was content to have my feet off the hard high road. It was still very close, the air heavy and hot, and one felt conscious of a very moist skin. We made coffee by the roadside at lunch time but did not feel inclined to eat.

There were beautiful little kingfishers flying about by the canal and I saw one on a willow tree with a fish in its mouth, knocking the fish's head against a branch before swallowing it.

The villages round here looked dreadfully poverty-stricken, and so very dirty. Nature helps the people here so much more than Ladakh that one wonders. The Ladakhi children looked so much cleaner and healthier than any of these children; yet here there is abundance of water for household and crops, rich soil, cheap grain, and walnut and fruit trees in profusion. I suppose a soft climate does not breed a hard-working people, but there must be something in race too. The first neglected children we saw were at Pashgyam above Kargil, where Hindu influence from Kashmir first becomes obvious. Since then we had not seen a clean healthy child, and the women looked so dirty and unattractive.

The valleys were very picturesque with their chalet type of houses made of mud bricks and wood, with a rough thatch of straw. There was a charming spot under willows a little distance from any village where the stream divided, going round several islands. Here we camped on one of the islands. Garry spent most of the day after he arrived in camp chasing frogs. Needless to say he never caught any. He had to be tied up as he got so thin when he was hunting all day.

R. took a photograph of our permanent staff, the seven servants, and one of me with Kelpie in my ordinary marching kit, which was so soon to be discarded.

That night we were attacked by every form of parasite. Fleas were rampant, and mosquitoes were everywhere. We cleared the tent of flies before we went to sleep but it soon filled again, and I even found the special parasite of Ladakh once more in my clothing. We got little sleep and were glad when early tea was brought and we dressed and got out of the tent. Luckily a tonga had been secured and we started off for Islamabad, leaving the baggage to follow on ponies. An empty motor lorry was returning to Srinagar, and we bargained with the man to take us all, servants, dogs and baggage. We were glad a lorry was available as we did not want to waste a night at Islamabad.

We had "elevens" beside the temple at Avantipur. By one o'clock we were at Major and Mrs. Skinner's house near the Sonwar Bagh. R. went on to the Army Agency to return some of the kit, as he thought it better to do this himself. The Kashmiri servants were paid off next day, and all had to get written testimonials.

I found a washing silk frock a very comfortable garment on a hot day after months of shorts and a riding coat.

The next few days were filled to overflowing in spite of the heat. R. had promised that we should have a fortnight's rest before returning to Kasauli, but we had not decided where to spend it. Gulmarg seemed the most suitable place if we could get rooms in a house in a quiet position. A house-boat sounded attractive, but we knew it would be very hot and mosquitoes troublesome. Major Broome suggested that we should go up to Gulmarg and have a look round, but first we had to see the skins and heads which had been entrusted to Salaama the taxidermist. That occupied a whole morning, as his workshop is far down the river. I was most interested to see his store. A large room overlooking a court-yard was

FIG. 31.—Our permanent staff. Jit Ram in the centre.

littered with a great variety of heads and skins. In a corner thousands of fox skins were piled one above another; bear skins were nailed on the walls, and stone martens were hanging from the roof in bundles like rabbit skins, but I saw none so good as those we got in Leh.

He brought us tea while we waited—what they call Lhassa tea, boiled with sugar in it. I thought it safe if we didn't take the milk and I found it most refreshing. The heads were not yet ready, but we arranged to have the marmots made into a motor rug.

XXXIII.—A BEAR.

Mrs. Skinner had lunch made up for us next morning and we started off in the car after breakfast for Gulmarg. It was an easy run. We parked the car and got two ponies to ride up the hill. It was a lovely day and the air was delightfully cool. We had lunch near the gap leading to the natural

basin where Gulmarg lies. We then rode to Mrs. O'Connor's, a boarding house that had been recommended to us, but were disappointed to find that a tent was all she had to offer. We didn't mind tents when we were dressed for camping, but to dress for dinner in a tent in the rains did not appeal to us. Other places we tried with no success before we had tea at the club with Mrs. Renshaw, a friend from Lahore. We both felt inwardly that we were not yet ready for club life. We saw girls walking about the golf course in high heeled shoes, and the people who turned up at the club for tea were, as R. put it, very much togged up.

No; Gulmarg was too fashionable for us, and so we returned to Srinagar; the peaceful life on a house-boat appealed to us more and more. We talked it over with Major Broome at dinner that night, and went with him next morning to look at boats. We decided on one called "Zaffaran"; it was large and airy, well furnished, and had gauze windows which would help to keep out mosquitoes. The caretaker was told to have the boat well cleaned as we would be moving in next day, and we returned to the house with the intention of packing up. The temperature was 95° in the shade, and it was unpleasantly moist.

Major Broome had told us an amusing tale about two young subalterns firing off 49 cartridges at a black bear with no result. The local shikari was very depressed about it, and said that a sahib who could shoot would easily get one. He had heard about the big heads R. got in Ladakh, and had been hanging about the Army Agency in the hope of seeing him and persuading him to go. During lunch this shikari appeared at the house and said there were two bears in a nullah about twelve miles away. R. was quite keen to have a try, and Major Broome was very keen for him to give the shikari a chance. The man's reputation depended on a bear being brought back. So R. went off for his rifle, changed into his old coat, and he and the shikari had started in the car within ten minutes.

He was back in time for dinner, having shot a bear. The place was much further away than he expected, and he had motored for miles across country on a rough bullock cart-track, taking great risks of smashing up the car crossing streams and broken bridges. Then he had miles to walk, but sure enough the shikari spotted a bear in some dense jungle. There was no chance of a shot, so about twenty villagers were collected to drive it out. The drive commenced in the proper way, very quietly, the men gradually converging on the bear. The stillness didn't last long. Soon every man, including the shikari, was yelling himself hoarse, and they hurled great stones into the jungle, getting nearer and nearer. There was now no hope of the bear slowly slinking away as R. hoped would happen, and at last it darted out with a grunt. As the next cover was only a few yards away he had only time to have a snap shot which wounded it badly, and he killed it with a second bullet. All the villagers went mad with delight, and with great shouts and laughter they dragged the body into the open. It was now getting dark so R. hurried back to the car, rather dreading

that awful country road in the dark, but he got back without mishap. The skin arrived next morning. It was a very good one, uncommonly soft and glossy black, and it was sent to the man who was setting up the heads.

XXXIV.—The House-Boat.

Our baggage was put on board the " Zaffaran " and she was moved to the Nasim Bagh on the Dal Lake. We drove round by the road later in the day.

It was a happy fortnight on the house-boat. After so much trekking we were very glad to rest, as we had done nine hundred miles marching. There was plenty to think about and as much as we wanted to do. Unfortunately the temperature hardly dropped although we had frequent thunderstorms. These usually started about four in the morning, and as we slept on deck, we had much ado to get ourselves and our bedding down the little stairway and under cover.

It was a restful routine. Day after day we got up at six o'clock and I went sketching on the lake, getting back for breakfast under the trees. Later we took the dogs out in the shikara, our small boat, and put them overboard in turn. We wore our old shikar clothes on these occasions as sometimes we were nearly as wet as the dogs. In the cool of the evening we rowed far out and I had a swim. The clear waters of the lake, with their beds of lotus lilies, the hills above and the green turf under our feet, made perfect surroundings for our last two weeks.

Pedlars came with their wares in small boats; one boat so full of crockery there was not a square inch of space in it. Beautiful embroidered bedspreads were opened at our feet as we drank tea under the trees.

It was all arcadian and made me feel I was living in a story book. It was so peaceful that in spite of the heat and the myriads of mosquitoes, I was very sorry when our time was up. For four months we had been away from the usual little worries of life and the daily routine with its narrower outlook. These last days had a peculiar charm, but the strings would soon have to be picked up again. Our thoughts were flying ahead to work awaiting us in Kasauli. R.'s happy busy Sundays there with crowds of poor people from near and far distant villages, then long walks with the dogs in the evenings. Looking further ahead, we might even be in London in a year's time, the greatest possible change after the freedom and open air life of India.

This had been the kind of holiday that we and many others had dreamed of, and for us the dream had come true. Some people said they would not call it a holiday at all—it was too much like hard work—but it was a very real recreation to us, and is such even in memory.

Two more nights in Srinagar, and we started on our six hundred mile motor run to Kasauli, the very end of our long long trail.

Finis.

Current Literature.

HENRY, X. **Seroflokkulation bei Malaria. Tecknik und Anwendung in der Praxis.** (Serofiocculation in Malaria: Technique and Employment in Practice.) *Archiv. f. Schiffs u. Tropen-Hygiene.* 1934, v. 38, 93.

In 1927, Henry, working in the Bacteriological Laboratory, Constantine, Algeria, described sero-flocculation tests for the diagnosis of malaria, and in the paper under review, which was read in Eberfeld in June, 1933, he gives a summary of the present-day technique of the test. Two methods of testing are described, ferro-flocculation and melano-flocculation. In the former the substance now used by Henry is lamellar iron albuminate prepared by the firm of Merck, Darmstadt. However, he says this test is not so reliable as melano-flocculation, since it is not specific for malaria.

In the melano-flocculation test melanin from three sources has been employed, from cuttle fish, from melanotic sarcoma of the horse, and from the choroid membrane of the eye of the ox, and it is the last that Henry now recommends. He gives full details of the method of obtaining the melanin and of the preparation of suspensions for use. In the tests two amounts (0·2 and 0·3 cubic centimetre) of a patient's serum are put in test tubes with two strengths of melanin suspension in water, controls are also put up. The test tubes are incubated for two hours and forty-five minutes at 37° C., and are then left at room temperature for twenty minutes before a reading is made. It is best to read with the naked eye and a positive result is shown by the formation of distinct floccules, while there is no flocculation in the control tubes.

The test is said to be of value in early stages of malaria, and especially in malignant tertian malaria, when parasites may be scanty in the peripheral blood. The test may also be of value in "larval" cases and in chronic malaria. A. D.

LACOUR, R. R. **Recherches sur la Malaria-floculation de Henry. Thése pour le doctorat en médecine.** Lyon, 1933. (Summarized in *Archiv. de Médecine et de Pharmacie Militaires*). 1934. v. 101, 96.

The author employed Henry's melano-flocculation test on the sera of 381 individuals, of whom 140 were suffering from malaria, or had suffered from the disease. Twenty-eight cases with malaria parasites present in the blood all gave a positive reaction. Of 50 sera from patients who had suffered from the disease more or less recently, but who did not show parasites in the blood at the time of test, 44 gave a positive reaction and 6 were negative. Sixty-five patients were tested who had suffered from an attack of malaria a long time ago (time not stated) while serving with the

"Army of the Orient," and who had returned to France soon after their attack, 55 were negative, 4 positive and 6 incomplete. Of 162 patients suffering from diseases other than malaria 158 gave negative and 4 gave positive results, but it is not stated from what diseases the four positive patients were suffering. Sixty-eight healthy individuals all gave negative results.

A. D.

GREIG, E. D. W., van ROOYEN, C. E. and HENDRY, E. R. **Serological Diagnosis of Latent Malaria.** *Lancet*, 1934, v. 1, 1393.

The authors state that in preparing melanin for Henry's test the suspensions obtained from choroid membrane are not always satisfactory on account of the amount of material other than melanin they may contain. They also criticize Henry's technique in that it does not assess the positivity of the reaction. They recommend the use of melanin pigment obtained from human hair by hydrolysing the hair in fifty per cent hydrochloric acid, then concentrating *in vacuo* and purifying by dialysing through a collodion membrane. Nine dilutions of the patient's serum are put up, an equal volume (0·4 cubic centimetre) of pigment solution is added to each dilution and a reading is made after four and a half hours' incubation at 37° C., a positive result being shown by the presence of a white granular precipitate at the bottom of the tube. The method was tested on benign tertian malaria induced in G.P.I. cases. A positive reaction appeared in from five to seven days after infection, although no parasites were to be found in the blood at that time and fever had not appeared. The maximum reaction was found about the fourth week. Controls on 129 patients not suffering from malaria gave two positive results (the diseases are not stated).

Heating at 55° C. for thirty minutes was found to inactivate positive sera. The authors consider that melano-precipitation is a better name than melano-flocculation.

A. D.

JORDAN, E. O. **Essentials of Typhoid Fever Control To-day.** *Amer. J. Pub. Health.* 1934, v. 24, 349-54.

Unceasing, skilled and conscientious attention is as necessary to-day as ever in preventing water-borne typhoid fever. Approximately 40 per cent of the outbreaks of reported water-borne illness in the United States during the decade 1920-29 have been shown to arise in defects in the collection, treatment, storage or distribution of the water, and not by pollution of a raw water at its source. The chief reason for the incidence shifting from the large population group to the small ones is the superior urban control exercised over drinking water. As regards milk supply also the smaller communities are at a disadvantage for properly pasteurized milk is less easily come by in small towns and villages than in cities. From the standpoint of efficiency and administrative economy, removal of the

gall-bladder is probably the best method of dealing with carriers. The risks of operation for persons of suitable age and physical condition seem to be justified since chronic infections of the gall-bladder are likely sooner or later to affect seriously the health of the carriers. All preventive measures reduce the numbers involved so that the "typhoid carrier is passing off the stage." Available figures give some evidence of this. The age distribution of 220 carriers in South West Germany, 1906-7, compared with that of 368 carriers in New York State, 1911-32, shows a larger proportion over 50 years of age in the more recent years. Inoculation should be mandatory in asylums and all custodial institutions and all persons exposed to special risk by their mode of life, e.g. physicians, nurses, medical students, should be inoculated as a routine practice. Of the advantages of general civilian vaccination we need more evidence. Unless control is exercised in a given area over water supply, excreta disposal and other well-known factors, the results from wholesale vaccination may be disappointing. If these basic sanitary measures are properly carried out, general vaccination may be unnecessary.

A. Bradford Hill.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 7.

Baars, J. K. Drinkwater-desinfectie. **[Disinfection of Drinking Water].** *Meded. Dienst d. Volksgezondheid in Nederl.-Indië.* 1934, v. 23, 1-5. English summary.

The statements have been made that the disinfecting action of chlorine is greater than that of chloramine and that the action of both these substances diminishes with rise in pH. With these statements the author does not agree. He has carried out experiments for a range of pH from 5 to 9·1, using a suspension of about 500,000 *Bact. coli* per cubic centimetre as the testing reagent and a dose of disinfectant of 0·2 milligramme per litre. These experiments, conducted upon the tap water of Batavia with a chlorine-binding power of zero and at a temperature of 30° C., have shown that, although the action of chlorine in an alkaline medium (pH 8 to 9) is rather quicker than that of chloramine, this difference disappears after two hours' action. The same applies to disinfection in acid medium. Thus there is no objection to the use of chloramine instead of chlorine on grounds of potency. It is claimed, moreover, that "pre-ammoniation" prevents the occurrence of the bad taste of water, due to reaction of the disinfectant with organic compounds, such as phenols which may be present, or to excess of residual chlorine. The water also remains longer of good quality and the process is a cheaper one.

W. F. Harvey.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 7.

Reviews.

MOTHERHOOD: A GUIDE FOR MOTHERS. Guildford: Cow and Gate, Ltd. 1934. Pp. 246. Price 1s.

This book, now in its fourth edition, is excellently printed and illustrated, and contains much information in simple language which should be of the utmost use to mothers and expectant mothers. It deals with such diversified subjects as vitamins, the premature baby, baby's advice to mother, mixed feeding, preparing for baby's arrival, recipes, etc., and contains much other sound advice to mothers.

The splendid photographs of the numerous prize-winning children at various competitions, fed on the products of Cow and Gate, indicate the quality of the infants' foods issued by this enterprising firm.

It is excellent value for one shilling.

RHEUMATISM IN GENERAL PRACTICE. By Matthew B. Ray, D.S.O., M.D.(Edin.). London: H. K. Lewis and Co., Ltd. 1934. Pp. viii + 404. Price 16s. net.

Dr. Ray brings a wide experience of all manifestations of rheumatism to his aid in writing what is in many respects a pioneer work.

The book is an important contribution to medicine because we here have this difficult group of affections systematically analysed and dealt with under their several distinct headings.

When such an authority as Lord Horder writes a favourable foreword, a detailed review becomes unnecessary, but we would especially draw attention to the chapter on Rheumatism in Children which should be read by every doctor.

Among other excellent features of this book one may mention the clear analyses of such conditions as rheumatoid and osteo-arthritis with the excellent X-ray reproductions of the essential changes in these diseases.

This book is likely to be a standard reference work on the subject of "rheumatism" for a long time.

J. H.-S.

STUDENTS' POCKET PRESCRIBER AND GUIDE TO PRESCRIPTION WRITING. By David Mitchell Macdonald, M.D., F.R.C.P.E. Edinburgh: E. and S. Livingstone. 1934. Pp. 263. Price 3s. net.

The tenth edition of Macdonald's Pocket Prescriber is to hand. It follows the usual lines of pocket prescribers containing posological tables, directions for dieting disease, hints on prescribing, etc. A large part of the book is devoted to prescriptions recommended for different affections. Many of these are good, but some appear to owe their continued presence to the mere fact that they have come down to us from the dim past. Some are definitely bad, as for instance the exhibition of astringents and opium in cholera where success so much depends upon avoiding such drugs. We frankly do not like *hypodermic* injections of quinine in malaria, nor are we impressed by a combination of turpentine and opium in acute dysentery.

These may be some exceptions in an otherwise good little book, but the modern student deserves better guidance than he is likely to obtain from some of the contents of this pocket prescriber in its present form.

J. H.-S.

HANDBOOK OF THERAPEUTICS. By David Campbell, M.C., M.A., B.Sc., M.D., F.R.F.P.S. Edinburgh: E. and S. Livingstone. 1934. Pp. xx + 444. Price 12s. net.

The second edition of Dr. Campbell's book appears four years after the first publication and will be welcomed.

In spite of its modest size, this is a very comprehensive work and covers the whole ground of modern therapeutics.

The first chapters deal with drugs, prescriptions and modes of administering remedies. There are sections devoted to vaccines and sera, and to massage and electrical treatments.

The main part of the book deals with the appropriate individual treatment of different diseases and will be found useful as a reference volume.

We do not, however, agree with the wisdom of waiting for bacterial diagnosis in acute bacillary dysentery before employing serum—at least not in the tropics, and the author makes no mention of the safer preparations of antimony now used in leishmaniasis. No book of this size can, however, contain everything, and it is in no carping spirit that we mention some minor omissions.

The volume will be of considerable value to students and practitioners who require a handy reference work. The type is excellent, and the illustrations are good.

J. H.-S.

A SYNOPSIS OF HYGIENE. By W. Wilson Jameson, M.A., M.D., F.R.C.P., D.P.H., and G. S. Parkinson, D.S.O., M.R.C.S., L.R.C.P., D.P.H. Fourth Edition. London: J. A. Campbell. Pp. vi + 619. Price 21s.

The value of this book to public health students is apparent from the fact that a fourth edition has now become necessary.

In this edition the subject matter has been completely re-arranged; meteorology has been relegated to an appendix, while certain statistical matter and the appendix on public health chemistry appearing in the previous edition have been omitted.

In spite of the saving of space resulting from these omissions the book has increased in bulk by some seventy-four pages of close print, the section on Sanitary Law accounting for a considerable proportion of this increase.

The increasing tendency in public health work to deal by legislation with important matters affecting the health of the people of this country is well shown by the greater space required to deal with the legal knowledge which has become such an essential part of the equipment of a successful Medical Officer of Health. In 1920 this required sixty pages, and, with successive increases in the intervening editions, no fewer than one hundred and four pages are now found to be necessary.

The book is, as such a synopsis ought to be, a mine of useful information of the most up-to-date character concerning all aspects of modern preventive medicine, while the practice of giving references in the text to documents and papers from which fuller information may be obtained has much to recommend it.

The information given is extremely accurate, but in a book of this standard it is surely desirable to describe the mesh of mosquito netting in a more scientific manner than by the old method of the number of holes per linear inch.

In the chapter on Disinfection when discussing the fumigation of ships a considerable amount of space is given up to the consideration of the different methods of applying hydrogen cyanide while the use of sulphur is dismissed in a few lines, the Clayton apparatus not even being mentioned. While it is admitted that there is an increasing tendency to use hydrogen cyanide recent investigations would appear to point to the conclusion that, if attention to detail is given, the use of sulphur dioxide is attended by equally satisfactory results.

The compilation of such a work entails a vast amount of labour, and the authors, including Dr. G. P. Crowden, who is responsible for an excellent chapter on Personal Hygiene, are to be congratulated on the production of a most valuable book which should be in the possession of every candidate for a Diploma in Public Health.

THE LIVERPOOL MEDICAL SCHOOL, 1834-1934. By Arthur A. Gemmell (Lecturer in Obstetrics and Gynæcology in the University of Liverpool). University Press of Liverpool. London: Hodder and Stoughton. 1934. Pp. 23. Price 1s.

This small book is based on a lecture given to the Medical Students' Debating Society at Liverpool, and it gives a brief history of the teaching of medicine in Liverpool. The School may be considered to have originated in 1789, when the Medical Board of Liverpool Infirmary was made an examining board for the selection of surgeons for slave ships; each of these ships was required by law to carry one surgeon. These duties were carried out till 1802, by which time 634 candidates had been examined and 500 passed.

Interesting glimpses are given of the medical conditions in the early days, tales of the anatomy department and of the state of nursing.

A hint on the selection of candidates for the Army Medical Service in the days when the supply had become greater than the demand may be found in the history of this School. In 1852 the lecturers instituted the awarding of a gold medal to the best student of the year, and the Committee of the Royal Infirmary granted him free residence and a clerkship and dressership for six months.

The author says that the status of the School at this time was so good that two years after the Gold Medal was founded the Director-General of

the Army Medical Service offered to recommend the successful candidate for appointment in the Service.

The pamphlet is illustrated with photographs of old and new buildings of the Hospital and School.

BLOOD DISEASES IN GENERAL PRACTICE. By A. Piney, M.D., M.R.C.P. Pocket Monographs on Practical Medicine. London: John Bale, Sons and Danielsson. 1934. Pp. 92. Price 2s. 6d.

Dr. Piney's works on the blood and its diseases are well known, and he has performed a valuable service in giving this short survey of the subject in the latest volume of Bales' Pocket Monographs. He states in the preface that he feels that the book is very incomplete, but he has been remarkably successful in compressing into ninety small pages a vast amount of information presented in a pleasantly readable form.

In the introductory chapter there is a summary of the theories of the development of the blood, so far as they are useful in helping in the study of the various diseases. The following chapters deal with the anæmias of infancy and childhood, the anæmias, hæmorrhagic disease, the leukæmias, polycythæmia, Hodgkin's disease, some diseases of the spleen, glandular fever and agranulocytosis.

The volume can be recommended as giving a very clear and by no means scrappy survey of a subject which is of great importance to every variety of medical practitioner.

MEMOIRS OF A CAMP FOLLOWER. By Philip Gosse. London: Longmans Green and Co. Ltd. 1934. Pp. xvi + 300. Price 10s. 6d. net.

"Memoirs of a Camp Follower" is a most unusual war book; every chapter is interesting and most contain many amusing episodes. The author, a temporary medical officer and a keen naturalist, served in France and India, visited West Africa, South Africa and Salonika, and travelled through France and Italy on the long troop train journey from Taranto to Havre. He says in the preface that he has forgotten most of the "horrors" of the War and remembers the beasts and birds, about which he makes many fascinating observations which are so delightfully recorded that they will be read with interest even by those whose knowledge of birds is slight. He has also remembered many amusing episodes and is a skilled story-teller. He thinks the fact that the medical branch of the Army was almost the only one which never broke down was probably because the vast majority of the R.A.M.C. officers were civilian doctors.

The author was transferred to India in the autumn of 1917 and was stationed in Poona but managed to see a good deal of South India on troop-train duty and on sick leave. He at once began collecting small mammals and making observations on birds and his seeing eye will probably be envied by many who have served there.

The memoirs form a fascinating volume which is amusing and instructive, and which will bear several readings.

Correspondence.

VACCINATION OF THE ROYAL TANK CORPS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—With reference to "Vaccination of Royal Tank Corps Recruits," by Major S. J. L. Lindeman, M.C., in the JOURNAL for May, I notice he states that "the lymph was blown out on to the cleansed area."

If one end only of the tube is broken off by a pair of sterile forceps and the tube then grasped about the centre with the pair of forceps and the other end *brought up* to a spirit lamp, the lymph can be easily and quickly ejected, either into a sterilized watch-glass or on the sterilized handle of an ordinary scalpel, and then applied to the cleansed area in two or more marks. One stroke, ¼ inch, only is necessary at each mark made by the point of the scalpel, but if more than one mark is made they should be parallel, as there is less likelihood of drawing blood. This procedure is quicker than the "blowing" one, the number of severe reactions is less than half, the number of failures little, if any, more; and, in addition, it will be found that three or four per cent of lymph tubes have not been properly sealed at both ends—this is obvious when the end is put in the flame: these tubes I have always discarded.

Prospect,
Bermuda.
June 22, 1934.

I am, &c.,
R. A. FLOOD,
Major, R.A.M.C.

Notices.

BRITISH MEDICAL ASSOCIATION MEETING, BOURNEMOUTH, JULY 23-27, 1934.

BURROUGHS WELLCOME AND CO., pioneers in the presentation of digitalis medicaments, exhibited digoxin, a pure stable crystallized glucoside, isolated from the leaves of *Digitalis lanata*. The glucoside requires no biological standardization and may be viewed as the greatest advance in digitalis therapy of the century. It was subjected to thorough clinical trial by the Therapeutic Trials Committee of the British Medical Research Council before being placed on the market and may be used in all conditions where drugs of the digitalis series are indicated. Although rapid in effect when given by the mouth, digoxin can be administered intravenously when the urgency of the case so indicates. "Tabloid" and "Hypoloid" products, as well as a solution containing 0·5 milligramme per cubic centimetre, were exhibited in conjunction with illuminated explanatory notes.

"Tannafax," a jelly containing tannic acid in an antiseptic water-soluble base for use in the treatment of burns was also exhibited.

"Wellcome" Brand Sera, prepared at the Wellcome Physiological Research Laboratories, Beckenham, Kent, were represented, amongst others by "Wellcome" Anti-pneumococcus Sera, both concentrated and unconcentrated (high potency); Concentrated Gas-Gangrene Antitoxin Globulins; Concentrated Diphtheria Antitoxin Globulins; Streptococcus Antitoxin (Scarlatina) Globulins; Concentrated Tetanus Antitoxin Globulins, etc.

THE PARKES MEMORIAL PRIZE FOR 1935.

The Parkes Memorial Prize consisting of approximately thirty guineas in money with a gold medal will be awarded annually to the writer of the best essay on a subject connected with hygiene.

The Competition is open to the medical officers of the Royal Navy, Army, and Indian Army, on full pay, with the exception of the Professors and Assistant Professors of the Royal Naval Medical School, Greenwich, and of the Royal Army Medical College, London, during their term of office.

The subject for the Essay for the 1935 Parkes Prize will be optional, each competitor being allowed to select any subject dealing with Naval or Military Hygiene. All essays submitted will receive equal consideration, with the proviso that the subject chosen must have a direct bearing on Naval or Military Hygiene or on both.

Essays to be sent in to the Secretary of the "Parkes Memorial Fund," R.A.M. College, Millbank, S.W. 1, on or before June 30, 1935. Each essay to have a Motto, and to be accompanied with a sealed envelope bearing the same Motto and containing the name of the Competitor.

The Committee reserve the right to withhold the award should, in the opinion of the Assessors, no Essay attain a sufficiently high standard of merit.

By order of the Committee of the "Parkes Memorial Fund."

F. HARRIS, *Major, R.A.M.C.*

August 1, 1934. *Honorary Secretary, Prize Committee.*

"TABLOID" FINE-GRAIN DEVELOPER.

A DEVELOPER specially intended for the production of fine-grain negatives has been introduced by Burroughs Wellcome and Co. It is known as "Tabloid" Fine-Grain Developer and may be used for miniature or other films or plates which it is desired to enlarge to a considerable degree.

This is a developer possessing distinct and original features of its own. Its use does not demand increased exposure or increased development and it gives negatives free from fault or chemical blemish even when used with the fastest of fine-grain films. It is prepared from ingredients of exceptional purity, a point of great importance in miniature negative work.

Dissolved in plain water, it is a most satisfactory fine-grain developer for negatives designed to be enlarged up to about ten diameters (V.P.K. to 20 × 15 approximately), and has this further advantage, that if a 20 per cent solution of anhydrous sodium sulphite is used, instead of part of the water, the grain is still finer and permits of much greater degrees of enlargement.

A time-table is given of correct times for developing different films at different temperatures. Factors for factorial development are also given on the cartons so that development to the correct degree of contrast is rendered delightfully simple.

"Tabloid" Fine-Grain Developer is issued in cartons each containing materials sufficient for preparing 30 ounces of normal strength developer, or 60 ounces of tank developer.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

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MANAGER'S NOTICES.

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Journal
of the
Royal Army Medical Corps.

Original Communications.

RELAPSING FEVER IN CHITRAL.

By Captain ALBERT SACHS,
Royal Army Medical Corps.

Introduction.

Geographical.—Chitral State lies in the extreme North-West of India bordered on the South-West, West and North by Afghan provinces. On the East by Gilgit, Kashmir, and on the South by the State of Dir. It is surrounded by high mountains. Lying on the West is the main range of the Hindu Kush; to the North are the Pamirs, and separating Chitral from Gilgit is the Shandur Range. To the South-West, between Chitral and Dir, is the Hindu Raj Range, over which the road to India crosses the Lowari Pass—10,250 feet above sea-level.

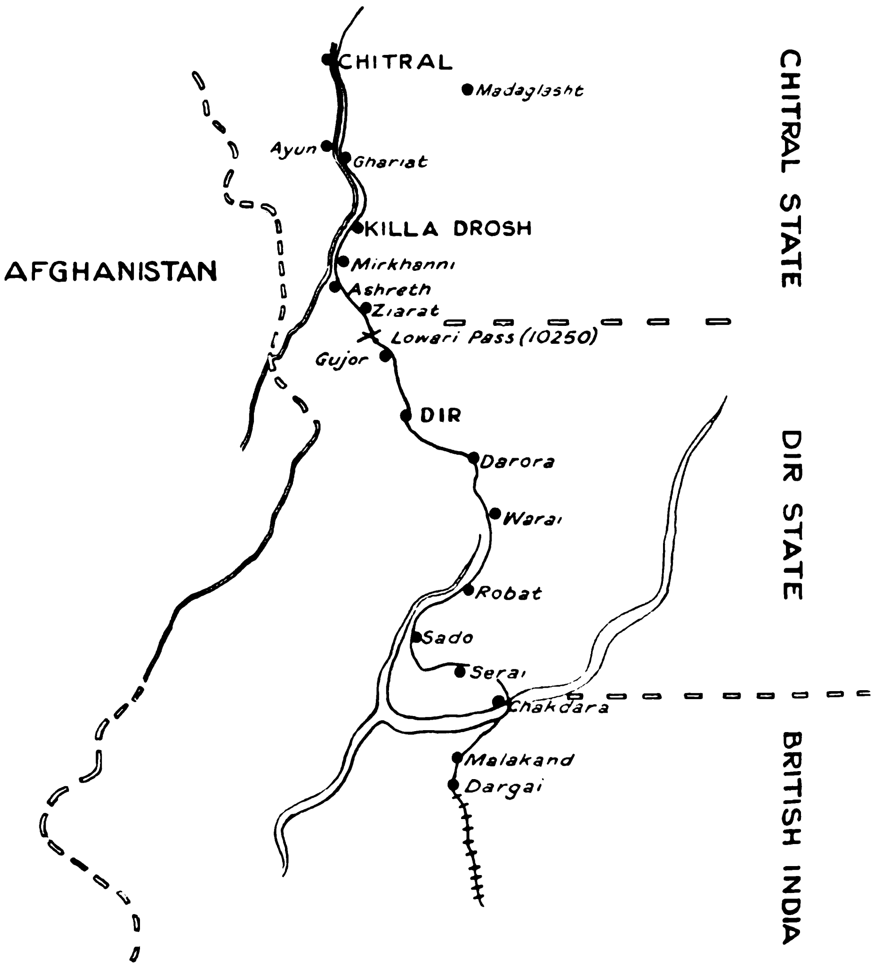
Indian troops are housed in the forts at Chitral and Drosh.

The usual method of travelling to Chitral is to proceed by rail from Nowshera to Dargai, and from thence by road. It is along this road that relapsing fever is contracted by troops proceeding and returning from leave. On leaving British India the road passes through Dir and Chitral States, and for the protection of travellers there are levy posts along the road, at which places only the night must be spent. The map shows these different posts.

It is now possible to motor to Dir from Dargai, as the road has been widened and improved. From Dir to Mirkhanni, a distance of twenty-eight miles, there is no proper road, but only a track along which mules can pass in the summer. During the winter months all transport work is done by coolies. The present ruler of Chitral has had several motor cars man-

handled across the Lowari Pass, and it is now possible to motor between Mirkhanni and Chitral.

For several years a number of cases having a relapsing type of fever have been reported from among the troops stationed in Chitral. Men using the Hindustan-Chitral road and those moving within the State of



Map of road to Chitral showing the levy posts and places referred to.

Chitral, are more liable to infection than those living in Drosh and Chitral Forts. The number of cases appears to be increasing yearly, and, so far, they have mostly been confined to Indian troops. No previous investigation had taken place, and nothing was definitely known about the ætiology of the fever.

Object of the Present Investigation.

In order to make a detailed study of the disease reported from Chitral, an investigation was instigated by Colonel E. W. C. Bradfield, C.I.E., I.M.S., A.D.M.S., Peshawar District; and I went up to Chitral on December 7, 1933.

Hindle (1931) has dealt with the various forms of human relapsing fevers in detail.

The majority of the Asiatic relapsing fevers resemble the European form in their general characteristics. Most of them seem to be transmitted by lice, although the Central Asiatic group is transmitted by the various species of Ornithodorus. The Quetta and Persian varieties of relapsing fever belong to the Central Asiatic group, which as a general rule seem to be transmitted by the agency of ticks, either *Ornithodorus tholozani, O. lahorensis* or *O. palpillepes.* It is possible that lice may also play some part in the spread of the infections, but hitherto the evidence has incriminated ticks.

Browse (1912) brought forward epidemiological evidence in support of the view that Quetta relapsing fever is transmitted by ticks, either *Argas persicus* or possibly *O. tholozani. A. persicus* has been suggested as a carrier of the Persian relapsing fever, but the evidence is very unsatisfactory.

The typical louse-borne relapsing fever rarely shows more than two or three febrile attacks. In the African tick-borne relapsing fever the number of febrile attacks is generally five or six.

The Quetta relapsing fever seems to resemble the African form for, in contrast with the usual one or two relapses of ordinary Indian relapsing fever, some of the patients showed six or seven.

Clinical Observations.

An analysis has been made of the medical case sheets of fifty cases that have occurred in Chitral during 1932 and 1933.

Symptoms.—The disease is characterized by sudden onset, with a rigor, intense headache and pains in the back and legs. There may be nausea, vomiting, giddiness, pains behind the eyes and some degree of rhinitis or pharyngitis in the severer cases. The temperature rises rapidly, often reaching 104° F. on the first day. The temperature is usually somewhere in the region of 101°—102° F. The fever may persist for one to five days, the average duration being two days, then the temperature falls by crisis. The pulse-rate is relatively slow when compared with the temperature.

In only one case of the whole series was the spleen found to be enlarged. Although carefully examined no case with enlargement of the liver, jaundice, or the presence of albumin in the urine has been found.

The primary pyrexial period is followed by an apyrexial period lasting from two to fourteen days, the average being eight days. This is followed by a second pyrexial period similar to the first. In a few cases the relapse was longer and more severe than the first attack. Sixty-four per cent of

both treated and untreated cases developed at least one relapse. Some cases had as many as five and six attacks of pyrexia.

If the number of relapses can be regarded as indicative of the type of fever, then it would appear that some of these cases showing more than one or two relapses differ from the ordinary Indian relapsing fever and resemble the fevers belonging to the Central Asiatic group, which is tick-borne.

Blood Picture.—Total and differential white cell counts are available in nineteen cases. In almost every case at least two blood-counts and in some cases four were made on different days of the disease.

A leucocytosis was generally present during the pyrexial period, though never very high. The highest count recorded was 15,000 leucocytes per cubic millimetre, while the average is about 11,000. The highest counts were found sometimes on the first day and at other times on the second day. Usually the leucocyte count decreased with a falling temperature and a leucopenia resulted. The average counts obtained at this stage were 5,500 leucocytes per cubic millimetre.

In the differential counts it was found that during the pyrexial leucocytosis the neutrophile polymorphs were increased. The percentage varied between 68 and 78, with an average of about 70 per cent.

Diagnosis.—This is made by finding the specific organism in the blood. The first attack is sometimes so mild that it is overlooked and the organism not found until the relapse. In about 50 per cent of the cases the spirochætes were scanty and difficult to find. In most cases they only remained in the blood for a short time while the temperature was rising, and disappeared with the defervescence.

The diagnosis has to be made from malaria and other febrile conditions. Owing to the similarity of onset and if the causative organism is not found, the case is often diagnosed as clinical malaria; but the spirochætes will be found in the blood during the relapse eight days later. A total and differential white cell count may assist in arriving at a diagnosis in those cases where no causative organism can be found, a leucocytosis being more common in relapsing fever than in malaria.

Prognosis.—No death occurred among the series of 106 cases under review. The above description and findings of the disease apply to the Indian troops in whom the attacks are relatively mild. No records are at present available as to the course of the disease among the local inhabitants. There are only three cases of relapsing fever on record among the civil population. One Chitrali in 1930 and one Indian private follower in 1932 were treated in the civil hospital, Drosh, but no details are available. A woman living in the bazaar at Drosh was recently found by the Officer Commanding, Indian Military Hospital, Drosh, to be suffering from relapsing fever.

Treatment.—Sulphostab was given with satisfactory results in doses varying from 0·3 to 0·6 gramme, depending upon the condition of the patient. In the relapses the larger doses are given. During convalescence the general health is attended to and tonics are given.

Incubation Period.—Owing to the difficulty in locating the exact places of infection it has been almost impossible to determine the incubation period exactly in the great majority of the cases.

In 1932 a party of men proceeding to Bluch Camp halted at Ghariat. During the night these men were bitten by some unknown insects. Five developed relapsing fever. The dates are as under :—

Case No.	Left Drosh	At Ghariat	First attack. Fever	Incubation period
60	8.5.32	8.5.32	16.5.32	8 days
61	8.5.32	8.5.32	14.5.32	6 days
62	8.5.32	8.5.32	14.5.32	6 days
63	10.5.32	10.5.32	20.5.32	10 days
66	8.5.32	8.5.32	23.5.32	15 days

The following men motored to Dir and were infected at one or other of the levy posts between Dir and Drosh where they had spent the night.

Case No.	Dir	Gujar	Ziarat	Mirkhanni	Drosh	Onset	Incubation
M.S.	19.3.32	20	—	—	21	27	7-8 days
121	8.12.33	9	—	10	11	19	9-11 days

From the above cases it is seen that the incubation period has varied between six and fifteen days. An approximate period may be obtained from the remaining cases if the number of days between the arrival in Drosh and the onset of the fever is regarded as the incubation period.

1– 5 days	2 cases
6–10 days	47 cases
11–15 days	7 cases
16–20 days	9 cases
21–26 days	3 cases
Total ..	68 cases

From the above figures it it evident that the incubation period varies within wide limits. The usual period seems to be between six and fifteen days.

EPIDEMIOLOGY.

Seasonal Incidence and Number of Cases.

It will be seen from the figures given below, which do not include relapses, that relapsing fever has been increasing during the past few years among the military garrison in Chitral. This increase has occurred in spite of rigid counter measures taken to prevent the spread of the disease.

Year		Total No. cases	No. contracted along the road	No. contracted in Chitral
1929	..	12	12	—
1930	..	13	12	1
1931	..	22	15	7
1932	..	25	14	11
1933	..	34	26	8
Total	..	106	79	27

The monthly incidence is shown by the following figures which represent the cases that occurred during the years 1929-33.

Column A.—Cases that contracted the disease along the Hindustan-Chitral Road while proceeding from British India through Dir State into Chitral State.

Column B.—Cases that contracted the disease within Chitral, i.e. those cases whose movements were confined to Chitral State.

Month		A.	B.	Totals
January	..	—	2	2
February	..	—	2	2
March	..	—	—	—
April	..	2	—	2
May	..	17	6	23
June	..	5	4	9
July	..	2	3	5
August	..	1	1	2
September	..	1	1	2
October	..	12	2	14
November	..	30	2	32
December	..	9	4	13
Totals	..	79	27	106

From the above figures it will be seen that whereas the greatest number of cases contracted along the road occurred during the early cold weather, the cases contracted in Chitral occurred during the hotter months, i.e. when troops were in camp.

Infected Areas i.e., Places where the Disease has been Contracted.

(*a*) *Drosh.*—As the following men had no recent movements from Drosh it is impossible for them to have contracted the disease elsewhere.

Case No.		Date of onset
27 (4/16 P.R.)	..	5.2.31
50 ,, ,,	..	4.1.32
64 ,, ,,	..	1.6.32
65 (21 A.T. Coy.)	..	3.6.32

Lieutenant M. Sendak, I.M.S., has sent me the details of a case diagnosed at Drosh among the civil population. During January, 1934, a woman who had occupied her present quarters in the bazaar for forty-five days, showed *Spirochæta recurrentis* in blood smears taken during her second attack of fever.

(*b*) *Ghariat.*—The following seven men had occasion to spend one night at this post. There they were bitten by some insect. These men had no other recent movement. Cases 60, 61, 62, 63 and 66 were part of an advance party which halted for a night at Ghariat. No cases occurred among the details of this section which went straight through to Bluch Camp. Charpoys were not used.

Case No.		Date at Ghariat		Date of onset
34 (21 A.T. Coy.)	..	10.10.31	..	10.10.31
60 (M.A. Sect. R.A.)	..	8.5.32	..	16.5.32
61 ,, ,, ,,	..	8.5.32	..	14.5.32
62 ,, ,, ,,	..	8.5.32	..	14.5.32
63 ,, ,, ,,	..	10.5.32	..	20.5.32
66 ,, ,, ,,	..	8.5.32	..	23.5.32
103 (1/1 P.R.)	..	15 7.33	..	28.7.33

(*c*) *Ayun.*—The following four cases had been in camp at Ayun for periods varying from one to five months. They had no other movements.

Case No.		Time in Ayun Camp		Date of onset
96 (S. & M.)	..	One month, returned to Drosh 16.6.33	..	17.6.33
97 (S. & M.)	..	Ditto	..	18.6.33
104 (S. & M.)	..	One and a half months	..	25.7.33
117 (Cook S. & M.)	..	Five months	..	3.12.33

(*d*) *Along the Hindustan-Chitral Road to Drosh.*

(1) Movements confined to the Ziarat-Drosh section of the road.

Case No.		Date of onset
45 (4/16 P.R.)	Went to Ziarat on 18.11.31 and remained there for four days. He returned to Drosh on 22.11.31	4.12.31
48 (21 A.T. Coy.)	Went to Ziarat on 28.11.31	11.12.31
52 (I.H.C.)	Went to Mirkhanni on 12.2.31 and to Kobati on 14.2.32, returning to Drosh on 16.2.32	24.2.32
118 (I.M.S.)	Inspected at Mirkhanni, Ziarat and Arundi between 13.11.33 and 20.11.33	29.11.33

(2) Movements confined to the Dir-Drosh section of the road. These men used all the levy posts.

Case No.	Left Drosh for Dir	Returned to Drosh from Dir	Date of onset
38 (I.H.C.)	27.10.31	3.11.31	3.11.31
103 (I.H.C.)	13.10.33	28.10.33	30.10.33

These men motored to Dir and used the posts on the dates given.

Case	Dir	Gujar	Ziarat	Mirkhanni	Arrived Drosh	Date of onset
M.S.	19.3	20.3	—	—	21.3	27.3
(M.E.S.)	1932	1932			1932	1932
70	4.10	—	5.10	6.10	7.10	23.10
(S. & M.)	1932		1932	1932	1932	1932
71	4.10	—	5.10	6.10	7.10	26·10
(1/1 P.R.)	1932		1932	1932	1932	1932
121	8.12	9·12	—	10.12	11.12	19.12
(1/1 P.R.)	1933	1933		1933	1933	1933

(3) Between Dargai and Drosh. Most of the remaining men who developed the disease had marched from Dargai to Drosh and had used the posts *en route*. No information is available as to the infection between Dargai and Dir. Dargai, Malakand and Chakdara seem to be free from the disease. Troops are stationed at these posts and a military medical officer is in charge of the civil hospitals there. During the past five years no case of relapsing fever has been reported from these places, either among the military or civil population.

The table on p. 224 shows the details of leave parties and drafts that arrived in Drosh from India.

From this the following facts may be obtained :—

		Strength	Cases	Per cent
(*a*)	Parties			
	Leave ..	23	1	7·3
	Drafts ..	135	23	17·7
	Total ..	158	24	15·2
(*b*)	To Dir	Strength	Cases	Per cent
	Motor ..	35	4	11·4
	Route March..	123	20	16·3
	Total ..	158	24	15·2

From the above figures, although the numbers are too small to be dogmatic about, it seems that the drafts are more liable to infection than parties returning from leave. These men had previously used the road on proceeding to India from Chitral State. It also appears that by motoring to Dir the chances of contracting the fever are slightly less than by

1st BATTALION 1st PUNJAB REGIMENT.

STATEMENT SHOWING DETAILS OF LEAVE PARTIES, DRAFTS, ETC., WHICH ARRIVED IN DROSH FROM INDIA, BETWEEN THE PERIOD FEBRUARY 24, 1933, TO DECEMBER 16, 1933.

Batch No.	Strength	Date leaving Dargai	Date leaving Chakdara	Cases of fever	Per cent.	Number of nights at Posts									Date of arrival in Drosh	Remarks
						Serai	Sado	Robat	Warai	Darora	Dir	Gujor	Ziarat	Mirk-hanni		
1	•2	Feb. 24	Feb. 25	—	—	—	—	1	—	—	1	1	—	1	Mar. 1	Motor to Dir
2	18	Apr. 18	Apr. 19	2	11	1	1	1	1	—	1	1	—	1	Apr. 26	Route March
3	16	Apr. 19	Apr. 20	5	31	1	1	1	1	1	1	1	—	1	Apr. 28	,, ,,
4	19	Apr. 20	Apr. 21	4	21	1	1	1	1	1	1	1	—	1	Apr. 29	,, ,,
5	16	Apr. 21	Apr. 22	1	6	1	1	1	1	1	1	1	—	1	Apr. 30	,, ,,
6	11	May 7	May 7	—	—	—	—	1	—	—	1	1	1	—	May 11	Motor to Dir
7	10	June 16	June 17	3	30	—	—	1	—	—	1	1	—	1	June 21	,, ,, ,,
8	•2	Aug. 28	Aug. 28	—	—	—	—	1	—	—	1	—	1	—	Aug. 31	,, ,, ,,
9	•15	Sept. 18	Sept. 19	1	17	1	1	1	1	1	1	—	1	—	Sept. 26	Route March
10	13	Sept. 19	Sept. 20	—	—	1	1	1	1	1	1	—	1	—	Sept. 27	,, ,,
11	11	Sept. 20	Sept. 21	—	—	1	1	1	1	1	1	—	1	—	Sept. 28	,, ,,
12	4	Oct. 1	Oct. 1	—	—	—	—	1	—	—	1	1	—	—	Oct. 3	Motor to Dir
13	15	Nov. 6	Nov. 7	7	47	1	1	1	1	1	1	1	—	1	Nov. 15	Route March
14	•4	Nov. 20	Nov. 20	—	—	—	—	—	—	—	2	1	—	—	Nov. 24	Motor to Dir
15	2	Dec. 8	Dec. 8	1	50	—	—	—	—	—	1	1	—	1	Dec. 11	,, ,, ,,
	158			24	15·2	8	8	13	8	7	16	11	5	8		

* Leave parties.

route march. It will be noticed, however, that with the exception of six men, all stayed the night at Robat Post. This post was rebuilt during the year and it seems less liable to be a place of infection than the others. All the parties halted one night at Dir. With the exception of Batch No. 9 all the parties in which cases occurred spent the night at Gujar and Mirkhanni Posts, but not at Ziarat.

It appears, therefore, that relapsing fever may be contracted in Chitral State at different places and also along the Hindustan-Chitral Road between Dir and Drosh.

Age and Service Incidence.

Details of cases by ages :—

Age ..	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31 and over.	Total
No. ..	1	7	9	18	2	8	10	6	9	4	2	5	2	2	23	108

Reported cases have occurred among men between the ages of 17 and 45. It is seen that most cases occurred among those whose age was 20. These eighteen cases contracted the fever while proceeding along the Hindustan-Chitral Road. The average age of the men in the drafts is about 20. This will account for the high incidence at that age. But men of all ages seem liable to contract the disease. Thirteen out of sixteen cases who contracted the disease in Chitral State were between the ages of 23 and 30.

The following figures give the details of cases according to their service in the Army.

Service	Under 1 year	2 years	3 years	4 years	5 years	6 years	7 years	8 years and over	Total
No. ..	2	24	11	10	11	10	10	42	120

The greatest number of cases has occurred among men who had between one and two years' service. The average age of men with this service is about 20.

Source of the Disease.

(*a*) *Along the Dir-Drosh section of the road.*

Troops in small parties using this road are only likely to come into contact with either the levies or coolies. It seems that the source must be from either of these or possibly from an animal reservoir.

Levies.—Blood smears taken from levies at the various posts were negative. The levies had previously been examined at different times by other medical officers with negative findings. Those at Ziarat and Mirkhanni were again examined during November, 1933, by Lieutenant Sendak with similar negative findings.

Coolies.—Blood smears were taken from several, but no one was found to be suffering from the disease.

Rodents.—All the posts showed signs of rodent infestation. Four mice were caught at Ziarat and one rat at Gujor. These were brought back to Peshawar and examined for the presence of spirochætes, but none was found by staining or dark ground examination.

(b) In Chitral.

The finding of a positive case in the bazaar at Drosh in a woman who had occupied her present quarter for forty-five days points to the existence of the disease among the civil population.

There is also a record that in 1930 one Chitrali and in 1932 one Indian private follower were treated in the civil hospital at Drosh, but no details are available. No cases were admitted into the civil hospital at Chitral.

Owing to the mentality of the inhabitants the medical officers very rarely see a case with fever other than phthisis or acute septic infection either in the civil hospital or on tour. Therefore, the task of finding out the infected rate of the locals and the question of immunity is extremely difficult.

(c) Remainder of Peshawar District.

With the exception of a case in 1929 no other case has been reported from either the civil or military hospitals.

MODE OF TRANSMISSION.

In nature all the known varieties of relapsing fever are transmitted by the agency of the blood-sucking arthropods, lice, and ticks, and possibly by bed bugs. In addition to the usual method of transmission by the agency of these specific intermediate hosts, it is possible for relapsing fever to be transmitted directly when any blood-sucking insect passes from biting an infected person almost immediately to another subject. If the proboscis is still contaminated with infected blood the infection may be introduced directly when the insect bites the new host.

Owing to the lack of information as to the transmission of the Chitral relapsing fever it was decided to search for all types of blood-sucking insects.

LEVY POSTS.

The rooms set aside in the levy posts for the use of troops had "lapaied" walls and floors. One was easily able to peel off layers of the floor and wall about an inch thick. Owing to this structure, insects and other arthropod pests could easily live between the layers of lapai, coming out to feed and returning. In each room there were one or more charpoys that had been kept for the use of troops.

A careful search was made in the "troops" rooms and the rooms occupied by the levies at Dir, Gujor, Ziarat and Mirkhanni. In addition Drosh Fort and the native bazaar and Ghariat Post were carefully examined.

In Drosh Fort, where extensive reconstructive work is taking place, the Officer Commanding the Station placed an "insect collecting" squad of four men at my disposal. The levies and coolies were examined for signs of lousiness. The findings follow.

(1) *Lice.*—I could not find any evidence of lousiness among the levies at Dir, Gujor, Ziarat and Mirkhanni.

At this time of the year the number of levies at the posts is small, and these negative findings should not be taken as general.

On the other hand, almost a hundred per cent of the coolies examined were either lousy or showed signs of lousiness.

Lice were also obtained from the local inhabitants at Drosh and Ghariat.

Nearly all the human lice belonged to the subspecies *Pediculus humanus corporis.*

Arthropods (unidentified) collected from fowls found at Drosh readily fed on human volunteers. These were also examined as possible carriers, as fowls were brought into every post at some time or other.

(2) *Ticks.*—With the exception of Ghariat Post no ticks were obtained from the rooms occupied by troops. In Ghariat several hundred ticks of the species *Argas persicus* were found behind the layers of lapai in the walls and floor (the indentification of the tick as *A. persicus* has been confirmed by the Director, Central Research Institute, Kasauli).

(3) *Bugs.*—With the exception of Mirkhanni, bugs were found at all the posts in the charpoys used by the sepoys. The bugs belonged to the species *Cimex lectularius.*

In February, 1932, Captain K. S. Fitch visited the posts at Mirkhanni, and Kohati and Ashret villages. He examined twenty levies and villagers and a number of charpoys. All the men's clothing showed numbers of lice, but on only one man were ticks (two) found. (Species not stated.)

On all charpoys there were numbers of bed bugs.

In June, 1932, Captain W. McAdam, I.M.S., obtained two dozen ticks from the foot of the walls in Ghariat Post. These were subsequently identified as *Ixodes reduvius.* In May, 1933, two ticks found on the bodies of McAdam and another officer were identified as the nymph stage of *Hyalomma ægyptum.*

The levy posts have been examined for the presence of arthropods on several occasions by different medical officers and sub-assistant surgeons. Bugs have nearly always been found in the charpoys used by the troops. Only at Ghariat have ticks been found. These were *Ixodes reduvius* and *A. persicus.*

The levies have nearly always been found free of lice, but lousiness has been described in all the posts at some time or other.

Evidence of Lousiness Among the Cases that had Contracted the Disease.

After perusing 102 Infectious Disease Notification Forms (A.F.A.-35), covering the period from January 1, 1930, to December 31, 1933, the following information was elicited.

Number of cases definitely stated to be free from lice	84
Number of cases on whom lice were found	3
Number of cases on whom nits were present	5
Number of cases about whose condition no mention is made	10
Total ..	102

Medical officers have been very careful in examining all batches during the segregation period. If the louse was the only carrier, one would then

expect the number of cases of lousiness to be far greater. But as fine combing was not done, some cases may have been missed.

A large number of the cases had complained of being bitten at one or other of the posts by some insects unknown. Several showed signs of insect bites.

The Senior Medical Officer, Chitral Garrison (November 24, 1930), in a letter to the Headquarters, Chitral Force, Drosh, draws attention to the fact that in spite of a careful search of the person, kit, bedding and clothes of the men in the drafts no lice or bugs were found, although some showed evident signs of having recently been bitten.

Captain Fitch (February, 1932), states that only two of the 1931 cases were found lousy on arrival. Three others were lousy on arrival, but these did not develop fever. About fifty per cent of the arrivals showed insect bites, which were similar to bed bug bites. Lice bites seemed to be in the minority.

Transmission Experiments.

Up to the present all attempts to transmit the disease from man to man by the agency of biting insects have failed.

Captain W. McAdam, while commanding the hospital at Drosh during 1932, carried out certain investigations. He could not discover any spirochætes when examining the ticks found by him at Ghariat. He also fed bugs on a case, but failed to transmit the disease by their agency or demonstrate any spirochætes in them. Lice taken from the clothes of a relapsing fever case were smeared out between slides. No spirochætes were found on examination after staining these smears.

Lieutenant M. Sendak carried out experiments on louse transmission. On November 24, 1933, he fed lice obtained from Chitralis on seven cases who had developed fever on that date and before any treatment had commenced. On December 2 and 4, i.e. eight and ten days later, these lice were crushed. Slides were prepared and then sent to the Central Research Institute, Kasauli, for examination. The Director of the Central Research Institute reported that in one of these slides a few spirochætes, morphologically indistinguishable from *S. recurrentis* were seen. The length and number of spirals were more or less the same as *S. recurrentis*.

On December 4, lice fed ten days previously on the infective cases were also crushed on the broken skin of three volunteers—two I.O.R.s and one Chitrali—but no case developed the fever.

Bugs, lice and ticks collected by me at the different posts during the visit to Chitral were allowed to feed on volunteers in Peshawar, but the presence of spirochætes was not determined in any one. One doubtful case occurred with the clinical symptoms of a first attack of relapsing fever, ten days after being bitten by a tick. But as spirochætes were not demonstrated in his blood smears and no subsequent attack of fever occurred, no importance can be attached to this.

Lieutenant M. Sendak has fed some of the *A. persicus* ticks found in

Ghariat on a case of relapsing fever, but failed to transmit the disease or demonstrate the presence of spirochætes in dissected specimens.

Laboratory and Experimental Work.

Causative Organism.

Morphology.—The spirochætes seen in the blood smears of cases showed great variation in size. Those measured were between 9 and 32 microns in length. The average length was 22 microns. The number of spiral turns of each organism varied between 5 and 15, the average being 10. The width was about 0·3 micron.

Staining.—The organism can be satisfactorily demonstrated in blood smears stained by the ordinary Leishman or Giemsa stain.

Cultivation.—Attempts to cultivate the organism in Fletcher's medium under conditions similar to those obtaining during the culturing of Leptospira were unsuccessful. Other methods were not attempted.

Pathogenic Action.—Rabbits and guinea-pigs were given subcutaneous inoculations of the following :—

(1) Citrated blood from a case.

(2) Fletcher's medium inoculated with a patient's infected blood.

(3) Glycerinated blood from a case.

(4) An emulsion of crushed lice fed on a case of relapsing fever ten days previously.

The animals did not develop any fever after the preliminary reactions, nor were spirochætes ever demonstrated in their blood by either staining or dark ground methods.

Serological Work.—In 1928 when Lieutenant-Colonel J. Cunningham was carrying out an investigation into the Indian relapsing fever, sera from Chitral cases were sent to him for agglutination against the strains he was working with. Blood smears, medical case sheets and temperature charts were also forwarded.

Of the twelve sent, only one gave agglutination with the louse-borne strains of spirochætes maintained at Kasauli. As no strains of spirochætes are now obtainable in India, further serological work cannot be undertaken at present.

Comments and Conclusion.

(1) The relapsing fever occurring in Chitral is caused by a spirochæte morphologically resembling *S. recurrentis*. The fever conforms in all respects to the known types. It is generally very mild and the first attacks have been missed. Its onset has a close resemblance to malaria, for which it has frequently been mistaken.

(2) The incubation period varies within wide limits, but appears to be between five and fifteen days.

(3) Clinically both tick and louse types of fever exist.

(4) The disease seems generally to be contracted at one of the levy posts along the Dir-Drosh section of the Hindustan-Chitral Road. It is far more prevalent in Chitral than previously supposed.

(5) During the Chitral Reliefs every second year a large number of troops march along the Hindustan-Chitral Road, yet no case of fever has occurred among these men either on the outward or homeward journey. These troops camped in the open, neither using the levy posts nor employing coolies. It therefore appears that either the levy posts or the coolies or most probably both play an important part in the spread of the disease.

(6) (*a*) No definite conclusions can be arrived at as to the mode of transmission. But it appears from the evidence available that the louse cannot be regarded as the only vector. Along the Dir-Drosh section of the road the bed bug comes under suspicion. (*b*) At Ghariat Post, which has been placed out of bounds to troops, there are no levies, nor are charpoys available for the troops to sleep on. Six out of sixteen men who halted one night there while proceeding to camp contracted the disease. No case of fever occurred among the other details who proceeded direct to camp without halting at this post. Conditions seem similar therefore to the African resthouses where the tick is the vector. That some of the cases developed the clinical tick-borne type of fever supports this theory. As the tick *A. persicus* was found in numbers at Ghariat Post it must be considered as a possible vector. (*c*) The cases contracted in Chitral State occurred mostly during the hot weather. This seasonal incidence is more in favour of the tick-borne type. (*d*) January to March are the most favourable months for lice breeding, yet the number of cases of fever for that period is less than any other.

(7) No definite evidence as to immunity is available. But the relatively small number of cases occurring points to the presence of a definite degree of natural immunity. Europeans seem to be less liable to the disease. Only two cases have been reported since January, 1929.

(8) The negative results following experimental work up to date have been disappointing. But until a much larger number of experiments have been carried out over a longer period with a corresponding improvement in technique, no conclusive results can be hoped for. A suitable laboratory with sufficient apparatus and animals under trained supervision should be established at Drosh. It is very unsatisfactory to carry out the investigation in Peshawar owing to the time taken for specimens to be received from Drosh.

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Note.—References made, but not mentioned above, to medical officers by name, have been taken from the office files available in the offices of the Assistant Director of Medical Services and the District Laboratory, Peshawar.

DYSENTERY AMONG TROOPS IN QUETTA.

PART II D.—THE NON-MANNITE FERMENTING GROUP OF ORGANISMS.

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(*Continued from p.* 167).

[Note.—The following remarks are based on the laboratory examination of 1,536 cases of dysentery from which 196 non-mannite fermenting organisms were isolated under circumstances suggestive of the pathogenicity of the organisms. *B. dysenteriæ* Shiga formed 10·4 per cent of the total organisms isolated, *B. dysenteriæ* Schmitz 5·6 per cent, and certain other probably pathogenic non-mannite fermenting organisms, about to be described, together formed 5 per cent.]

The non-mannite fermenting group of dysentery organisms has been a subject of inquiry in Quetta since 1932, when it was found, during an epidemic of dysentery in the autumn, that considerable numbers of such organisms were being encountered many of which, while biochemically similar to *B. dysenteriæ* Shiga or *B. dysenteriæ* Schmitz, failed to show serological relationship. These organisms, inagglutinable with sera prepared from *B. dysenteriæ* Shiga or *B. dysenteriæ* Schmitz, appeared under circumstances strongly suggestive of their causal relationship to dysentery, and it would seem that they should be included amongst the members of the non-mannite fermenting group of dysentery organisms.

This group of organisms is divided primarily into two subgroups by the production or non-production of indol in peptone media, i.e. an indol negative group of which *B. dysenteriæ* Shiga is the main member and an indol positive group represented most frequently by *B. dysenteriæ* Schmitz. Each of these subgroups is capable of further subdivision, both biochemically by the action of the organisms on dulcite and saccharose, and serologically as indicated in the table.

Non-mannite Fermenting Group.

Indol −					Indol +		
Dulcite acid		Dulcite alkaline			Saccharose acid	Saccharose alkaline	
1030	Newcastle	771	Shiga	1167	882	Schmitz 214	902

The figures in the table are the index numbers of the new strains of organisms belonging to this group from which type sera have been prepared.

Some of them have already been described as occurring in India. For example, Archer, working in Wellington in South India, noted an indol negative, dulcite-fermenting member of this group in a few of his cases which gave evidence of its pathogenic relation to them, and Manifold and Boyd, working in Poona, have for long recognized that the common variety of the indol positive non-mannite fermenting dysentery organism in India is not the typical *B. dysenteriæ* Schmitz, but a type of this to which they have given the index number of 214. This organism differs from *B. dysenteriæ* Schmitz only in that it is deficient in agglutinability with serum prepared from *B. dysenteriæ* Schmitz: military laboratories in India, therefore, are now supplied with agglutinating serum prepared from this commoner type of *B. dysenteriæ* Schmitz, instead of from the typical organism itself, with the result that many more agglutinable indol positive, non-mannite fermenting organisms are being found under circumstances indicating their pathogenic nature.

Another organism of this group apparently pathogenic in dysentery cases has been investigated in Newcastle by Clayton and Warren. It is peculiar in that it occasionally produces gas in glucose and dulcite, and also in that it is serologically related very closely to, if not identical with, an organism biochemically quite dissimilar, the *B. dysenteriæ* Flexner 88, described by Boyd. In the form found by Clayton and Warren it has so far not been isolated in Quetta, nor to our knowledge in India, but in the form of *B. dysenteriæ* Flexner 88 it is comparatively common as a cause of dysentery.

In addition to the above, three additional varieties of this group have been found in Quetta, of which two resemble *B. dysenteriæ* Shiga and one resembles *B. dysenteriæ* Schmitz in biochemical reactions. The above organisms all occurred in Quetta in cases clinically resembling dysentery, often almost in pure culture, and in most cases unaccompanied by other organisms akin in any appreciable way to the known pathogenic organisms. It is regretted that agglutination tests on the patients' sera were performed in very few of the cases, so that at present their claim to pathogenicity rests only on the circumstances under which they occurred and on their resemblance to the classical Shiga and Schmitz organisms. None of them was found in simple diarrhœa cases, nor during the course of examination of 6,000 specimens from normal individuals undergoing tests for dysentery before engagement as servants. The next step in the inquiry, i.e. to further investigate their claim to pathogenicity by agglutination tests on the blood of future cases as they occur, is proceeding. In the meantime it seems advisable to indicate the lines on which the inquiry is progressing and to give an account of the results so far obtained.

A.—Dulcite Fermenting, Indol Negative, Strains.

(1) *B. dysenteriæ* "type 1030." This appears to be the type described by Archer which he found in two cases occurring in South India. It is not

common in Quetta, and like all members of the non-mannite fermenting group is liable to be missed unless the medium on which the original culture is made is capable of affording luxuriant growth. The colonies of all these organisms are very tiny even on perfect media, and seldom reach the size of one millimetre in twenty-four hours growth. Like *B. dysenteriæ* Shiga, they grow scantily in fluid media, forming only a thin suspension in broth or peptone water.

The history of the type case (1030) is as follows:—

The illness commenced on the morning of September 27, 1932, with diarrhœa, and three loose motions occurred during the day. In the evening, blood and mucus appeared and the stools became very frequent, being accompanied by acute abdominal pain and tenesmus. Temperature rose to 103° F. and the patient became greatly prostrated. Between thirty and forty motions occurred during the night, and these on examination in the laboratory were found to consist of nothing but blood, mucus and pus, showing a typical bacillary exudate. Culture of the specimens revealed a practically pure growth of this Shiga-like organism; no other cause could be found. The illness lasted for four days and was treated in the usual way by salines.

The organism, as described by Archer, is morphologically similar to *B. dysenteriæ* Shiga, but biochemically differs in that dulcite is fermented after three or four days' incubation. It does not agglutinate with Shiga high-titre serum even in the lowest dilutions. It is moderately toxic to rabbits, so that care has to be exercised in the production of agglutinating sera, but a titre of 1 : 250 is readily obtainable with four graduated injections. With this type-serum agglutination tests have been carried out on sixteen organisms biochemically similar, all from definite cases of dysentery and all with positive results. The type-serum has no agglutinating effect on any other member of the non-mannite fermenting group.

When absorbed with *B. dysenteriæ* Shiga the agglutinins for *B. dysenteriæ* type 1030 are unaffected and absorption of Shiga serum with *B. dysenteriæ* type 1030 does not affect the titre of this serum to its homologous organism.

In connection with the preparation of agglutinating sera from this organism, it is worthy of note that it shows a pronounced tendency to become rough after subculture for some days, so much so that to maintain its smoothness frequent plating and selection of a smooth colony is necessary.

Although definite proof of pathogenicity is still lacking, evidence is accumulating to show the close relationship of this organism with severe attacks of dysentery. It has been found as far south in India as Wellington, and as far north as Razmak on the North-west Frontier.

(2) *B. dysenteriæ* (Newcastle).—No examples of this organism have so far been observed in Quetta, but cultures of several strains have been examined through the kindness of Drs. Clayton and Warren, who forwarded

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the culture tubes to Quetta by air. With the media in use in Quetta a bubble of gas was found in the fermented glucose and later in the fermented dulcite tube, and marked acid and gas formation was found to occur in a medium made with sterilized crude juice of various fruits, e.g. grapes, mangoes and melons. Notwithstanding these biochemical peculiarities, this organism agglutinates to full titre with a serum prepared from *B. dysenteriæ* Flexner 88, as already pointed out by Drs. Clayton and Warren, and similarly a serum made from the Newcastle organism agglutinates not only its homologous organism but also this Flexner organism to full titre.

B.—Dulcite Alkaline, Indol Negative, Strains.

(1) *B. dysenteriæ* type 771. This organism is morphologically and biochemically similar to *B. dysenteriæ* Shiga, but differs from it in that it will not agglutinate with Shiga agglutinating sera, even in the lowest dilutions. It is widely distributed in India, and strains have been received from as far south as Bangalore and as far north as Razmak. It is associated with a severe type of dysentery, the type-case history being as follows:—

Mali Sita Ram was admitted to the Cantonment Hospital, Quetta, with a history of three days fever and diarrhœa with blood and mucus in the stools. Twenty stools were recorded on fourth day of disease, 16 on fifth, 8 on sixth, 5 on seventh, and 1 on eighth: that is he had symptoms of a toxic dysentery for some seven days, during which specimens showed typical bacillary exudate and yielded the organism almost in pure culture on the first day or two after admission.

So far eleven strains of this organism have been examined in Quetta from dysentery cases which showed no other causative organism. All agglutinate to titre with the type-serum 771 and not with other sera. The type-serum (titre 1 : 250) does not affect other members of the group. It does not agglutinate *B. dysenteriæ* Shiga when tested by Dreyer's method in as low a dilution as 1 : 5.

The following table shows the results of absorption tests performed in connection with this organism:—

[*Note.*—In these and in all other absorption tests in this investigation the method of complete saturation with the absorbing organism was employed. The dose of organisms added to the serum was sufficient to ensure that after two hours at 37° C., and overnight at room temperature, the supernatant fluid still remained turbid, so that prolonged centrifuging was necessary to throw down the suspended (i.e. non-agglutinated) organism.]

	Shiga	"1167"	"771"
"771" serum control	—	—	1 in 250 = 100 per cent
"771" serum absorbed "Shiga"	—	—	100 per cent
,, ,, ,, "1167"	—	—	100 ,,
,, ,, ,, "771"	—	—	—
Shiga ,, ,, "771"	100 per cent	—	—

So far no agglutination tests with this organism have been positive with a patient's serum except in two cases when the serum was used undiluted on a slide. No proof therefore yet exists as to its pathogenicity.

(2) *B. dysenteriæ* type 1167. This is another Shiga-like organism similar to the last in its description and in its distribution. It is not affected by Shiga high-titre serum, nor by serum prepared from the *B. dysenteriæ* type 771 or any other member of the non-mannite fermenting group. Like the foregoing it is not strongly agglutinogenetic, so that difficulty has been experienced in this laboratory in producing an agglutinating serum of titre higher than 1 : 250. With this serum however ten similar organisms have been found to agglutinate to full titre. It appears therefore to be another type of the non-mannite fermenting group of organisms, although its only claim to pathogenicity is its similar association with fairly severe cases of dysentery. The history of the type case is as follows :—

Driver Masahib Khan became ill in July with dysentery symptoms accompanied by fever. He did not report sick for three days. On admission his temperature was 102° F. and he was definitely in a toxic condition. There was severe tenesmus and about twenty motions per day were passed. A single dose of anti-dysenteric serum combined with routine saline treatment brought about his recovery in three days. Specimens showed that the exudate was characteristic of bacillary dysentery, and from them this organism was obtained in practically pure culture.

The following table shows the absorption tests performed in connection with type 1167 organism.

	Shiga	"771	"1167'
"1167" serum control	—	—	1 in 250=100 per cent
"1167" serum absorbed Shiga	—	—	100 per cent
,, ,, ,, "771"	—	—	100 ,,
,, ,, ,, "1167"	—	—	—
Shiga serum ,, "1167"	100 per cent	—	—

(3) *B. dysenteriæ* Shiga. In the last two years, eighty-eight strains of this organism have been found agglutinable to titre with Shiga agglutinating serum. The seasonal incidence of this organism in the autumn of the two years and its scarcity in the spring has already been mentioned in Part I.

A certain peculiarity in the strains of Shiga's bacillus found locally in Quetta was observed in this laboratory. After growth for three weeks in saccharose peptone water a faint tinge of acidity was noticed inside the Durham's tube. To confirm this, three strains of each type of organism in the non-mannite fermenting group were inoculated into saccharose peptone water of pH 7·4, using phenol red as an indicator, so that the pH content could be noted daily. After the first day's growth increasing alkalinity was observed, until this reached pH 8. This point was reached after seven days' growth by the majority of the organisms, but in the case of the true Shiga organisms the time required was ten days. Observation after

this period was difficult because, even in uninoculated tubes, a brownish tinge developed in the medium, so that accurate comparison with the standard pH tubes was impossible. The three strains of true Shiga's bacillus, however, definitely produced slight acidity in saccharose after growth for twenty-five days in this medium, while the other strains did not.

C.—Saccharose Fermenting, Indol Positive, Strains.

No claim to pathogenicity is put forward for any of these organisms. The majority were found in normal individuals undergoing tests before engagement as servants and a certain number were found during the routine bacteriological examination of flies. A few occurred in old dysentery cases, and in no case was the organism found in large numbers.

D.-Saccharose Alkaline, Indol Positive, Strains.

(1) *B. dysenteriæ* Schmitz type 214. In two years sixty strains were isolated, all of them being agglutinated to titre with a serum prepared from the Indian variety of *B. dysenteriæ* Schmitz.

(2) *B. dysenteriæ* type 902. This organism appears to be another variety of *B. dysenteriæ* Schmitz, but of much less frequent occurrence. It is inagglutinable with serum prepared from *B. dysenteriæ* Schmitz or its Indian type 214 when tested by Dreyer's method in a dilution of 1 : 5 of the serum. Two cases have shown agglutination on a slide with stronger serum (Schmitz 214). A serum prepared from it has been found to agglutinate eleven other strains of similarly inagglutinable organisms, which were all isolated from clinical dysenteries under circumstances suggesting a pathogenic role. For example, Peon Rudri Datt was admitted in November after five days' illness. Stools consisted on admission of nothing but blood and mucus, but were not numerous, seven per day only. He was clinically not a severe case, but the exudates were definitely of a bacillary nature, and yielded this organism in large numbers. No other organism of a pathogenic nature was isolated.

The relationship of the organism with this case, and with the eleven other cases, combined with its similarity to *B. dysenteriæ* Schmitz is suggestive of its pathogenic nature. Absorption tests performed in connection with this organism are shown below :—

	Schmitz	Schmitz 214	902
902 serum control	—	—	1 : 250 = 100 per cent
902 serum absorbed Schmitz ..	—	—	100 per cent
,, ,, ,, Schmitz 214	—	—	100 ,,
,, ,, ,, 902 ..	—	—	—
Schmitz serum absorbed 902 ..	100 per cent	—	—
Schmitz 214 serum absorbed 902	—	100 per cent	—

Method of Isolation.—The mucus is washed in neutral or slightly alkaline sterile saline, and a small loopful of it is spread over three successive plates of litmus lactose agar so as to obtain discrete colonies as the

number of organisms on the loop diminishes sufficiently. After one day's incubation several blue colonies are picked off and each is inoculated into glucose, lactose, mannite, peptone water and on to agar; the plates are kept for another day in case the sugar reactions are negative, when a further series of colonies is examined.

On the second morning after receipt of the specimen, the sugar tubes are examined and the peptone water is tested for the presence of indol, i.e. after twenty-four hours' incubation. If the sugar reactions indicate the non-mannite fermenting group of dysentery organisms, a diagnosis based on serological reactions can now be given almost immediately by a slide agglutination test using agglutinating sera either from the indol negative organisms or the indol positive organisms of the group. If the organisms are indol negative four drops of a saline emulsion of the agar slopes are placed on a slide, each being mixed with a drop of one of the sera of the indol negative series, e.g. *B. dysenteriæ* Shiga, (1030), (771) and (1167). If indol positive, two sera only are employed, (214) and (902). A diagnosis can now be given and confirmed later by Dreyer's test and by further biochemical tests as to the action of the organism on dulcite.

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(*To be continued.*)

MALARIA CONTROL IN BENGAL.

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General.

Owing to its geographical situation and its geological formation, Bengal is one of the most malarious provinces in India. In a population of 50 millions, malaria causes 350,000 deaths in a year and it is estimated that at least 30 millions are infected with malaria parasites. Further, it is probable that 60,000 out of the 86,618 villages in the province are more or less severely affected by the disease.

The area covered is so large, problems presented are so varied, and methods recommended and adopted so diverse that it was thought a short summary might be of some interest. The author has been fortunate in that, as a member of the Committees referred to below, he has been in close touch with the question for the past four years.

Organization.

In the last two or three years energetic measures have been adopted and very serious steps have been and are being taken to combat the scourge. The Government of Bengal has been particularly active.

The Malaria Sub-Committee of the Sanitary Board of the Department of Public Health is working constantly and several large schemes put up by them have been approved and financial grants made for their operation.

In the past, anti-malaria work has largely been left to Municipalities, Cantonment Authorities, District and Union Boards, and to private enterprise on the part of various big business concerns. There was little or no co-ordination and the good work of one Local Authority might be, and was, nullified by the apathy of those adjacent.

At the end of 1930, the Army Department of the Government of India recommended the formation of Anti-Malaria Co-operative Committees, the personnel of which were to be representatives from the Cantonment and from all local bodies immediately adjoining; the object of such Committees being to co-ordinate the work of all authorities in and around Cantonments. Such a Committee was formed at Barrackpore and held its first quarterly meeting on February 18, 1931, and has met regularly every quarter since. In view of the success met with, it was decided to extend the scope of this Committee and in June, 1931 it was enlarged to include all local bodies within the Barrackpore Sub-Division and, in addition, the Chief Engineer of the Department of Public Health and the Chief

Engineer and Chief Medical Officer of the Eastern Bengal Railway were co-opted.

The results obtained have been beyond expectations. Local bodies have got together and, as a result, many problems in which two or more have been concerned have been solved : individual Authorities have benefited by the experience of others and an enthusiasm has been worked up which was not evident previously.

The Committee has also been the mouthpiece through which representation has been made on several subjects to the Provincial Government. A similar Committee has been formed and is doing good work in the Ramna Cantonment at Dacca.

It is proposed by the Government of Bengal to institute gradually similar co-operative committees in other districts in the Province.

Co-operation, also, is aimed at by the Malaria Sub-Committee of the Sanitary Board, and they have co-opted as members certain tea-garden doctors and malariologists of other big firms, railway malariologists, civil consulting engineers and others as required.

In addition to the above official organization certain others are doing good work. Chief of these are the Co-operative Anti-Malaria Societies, which commenced work as far back as 1908 and whose existence is largely due to the labours of Rai Bahadur Dr. G. C. Chatterjee. These societies are non-official and purely voluntary. There is a Central Co-operative Anti-Malaria Society, Limited, which was founded and registered under the Co-operative Act in 1919. At present there are over 2,000 of these societies in Bengal and the number is growing.

Funds for the work are obtained by donation and subscription and by loans from Government under the Co-operative Act. They are administered by the villagers for their common good and most of the labour is voluntary. Expert advice is given by local practitioners and others and by the Central Society. A very great deal of propaganda is done in this way and questions of cholera, kala-azar, beri-beri, etc., are also dealt with. These societies have done more to initiate a sanitary sense into the illiterate masses of the agrarian population than anything else.

General Considerations.

The greater part of Bengal consists of the Great Gangetic Delta which is largely marsh land and paddy fields intersected by innumerable rivers and streams ; this constitutes the whole of the East, Central and South Bengal. North Bengal consists of the Duars and foot-hills of the Himalayas, and West Bengal is flat country with many streams.

Population is concentrated in large towns, mostly on the banks of rivers, and the greater part of the remainder of the country is sparsely populated. In West Bengal population is chiefly concentrated in the coal-fields area, the remainder being agricultural for the cultivation of sugar-cane, etc. In North Bengal it is more evenly distributed over the numbers

of tea estates in that area. In Central, South and East Bengal it is mainly in large towns on river banks, but there are also large numbers of villages in this area which are chiefly given up to the cultivation of rice-paddy and jute.

GENERAL PROBLEMS.

In North Bengal the problem is comparatively simple. In the tea gardens measures for malaria control are very efficiently and energetically pursued by the firms concerned; their labours are, however, to some extent hampered by the condition of their surroundings. The areas not occupied by the gardens consist mainly of sparsely populated jungle and cultivated tracts. Cultivation is largely of cereals on the "terraced" system on hill sides and necessitates irrigation by gravity.

The position in the Central, Southern and Eastern portions of the Province is far more complicated. The whole of this area has been gradually formed by the silting up of the Ganges mouth and the formation of a huge delta. The whole country is therefore flat and intersected by innumerable rivers and streams which are tidal for over a hundred miles from the sea.

Nature's method of land reclamation is for the rivers in the flood season, bringing up large quantities of silt, to overflow into low-lying marsh areas where the silt is deposited thus raising the land level. Later this flood water re-enters the rivers and the greater volume, increasing the velocity of flow, scours out and deepens the river bed.

Population has inevitably concentrated along natural traffic arteries—the rivers—where the larger towns have gradually come into being. As civilization has progressed, so roads and railways have been built, and, in view of the low-lying nature of the country, these have had to be put on embankments. This has all seriously interfered with Nature's efforts.

In the past, man's attempts at land reclamation have been by the "embankment system" which consists of raising the banks of the rivers to prevent them overflowing into the marsh areas and providing sluice gates in these embankments to drain the water off such land when the rivers are at their lowest. The evil effects of this method of reclamation have been : (*a*) Decrease in the volume of water in the rivers and consequent lessened velocity thus causing silting up and resulting in obstruction to navigation and eventual complete stoppage of flow in the river; (*b*) the stoppage of the natural land raising process by silt; (*c*) the loss of fertility of the ground owing to absence of the manurial value of natural river silt; (*d*) obstruction to the natural drainage of urban areas; (*e*) the causation of malaria by leaving ideal mosquito breeding grounds in the low-lying reclaimed areas.

Wherever villages have sprung up and large towns come into being, earth has been needed for raising the land immediately round the huts and for raising the plinths of huts; in addition, clay has been required for plastering huts and for making bricks. Further, as road metal has to be

imported for very long distances, it is expensive and all but the first-class roads have to be made with broken brick—even the first-class roads have a bed of brick. To obtain earth and clay, holes have to be dug and consequently the whole country is dotted with large tanks. These tanks form, in the majority of cases, the only water supply for washing, bathing and drinking: in many cases they are choked with weed and form ideal mosquito breeding grounds.

Railway and road embankments require earth and consequently on both sides of all roads and railways are to be found long chains of "borrow pits" full of water and choked with weed.

One of the staple foods of the Bengalee is fish obtained from tanks and streams. The method of catching fish necessitates the damming of streams by the erection of fishing bunds; this impedes the natural flow of the water and causes large, stagnant pools which breed mosquitoes.

Although malaria is most rife and eradication of anopheline mosquitoes is of primary importance, kala-azar and dengue are very prevalent; the destruction of culicines is therefore also a necessity. In consequence, the use of Paris green as a larvicide is only of limited value.

The bamboo industry is a large one in the district and stagnant water lying in hollow stumps is a fruitful source of mosquito breeding.

Special Problems.

In addition to larger considerations which are more or less general, certain minor problems arise in special areas. Of these the following are the most important:—

(1) The main sewage and storm water outlet for the city of Calcutta is the Bidyadhari River which flows out through the Sunderbans southeastwards. Owing to the expansion of the city and the effect of previous land reclamation schemes, this river has rapidly silted up and as a result it has become a sluggish sewer quite inadequate to deal with the volume required of it, and consequently Calcutta is constantly being flooded during the monsoon periods; furthermore, this and other rivers in the vicinity can no longer be used for the large country-boat traffic.

(2) As a further result of the blocking of the Bidyadhari and other rivers there are very large lakes immediately to the east of Calcutta. These lakes are full of brackish, salty water and are known as the "Salt Lakes."

(3) For many years *Anopheles ludlowii*—a mosquito particularly active as a carrier of malaria—has been breeding in the outer Sunderbans. This mosquito which breeds only in brackish water, was probably originally imported from Malaya by boats trading along the coast. In recent years this mosquito has worked its way nearer and nearer to Calcutta until now breeding places are found in the municipal area to the south, beyond the city to the north and in the Salt Lakes to the east. Spread has been much more rapid in the last two to three years. It is thought that adult

mosquitoes are brought up in railway carriages and in country boats bringing rice straw.

(4) In densely populated urban districts anti-mosquito campaigns are feasible, but in sparsely inhabited rural areas—specially large tracts of swampy jungle and areas given over to the cultivation of rice-paddy, etc.—they are to a great extent impracticable and other means have to be devised.

Mechanism of Malaria Control.

The next question which arises is: How are these problems being tackled?

The Bengal Government are constantly making malaria surveys throughout the Province, and maps and charts are maintained and kept up to date showing the spleen rate amongst children, varieties of mosquitoes breeding, etc., by districts. It has been abundantly proved elsewhere that haphazard antimalaria work without careful preliminary survey is not only useless, but may even be the cause of an increase in the incidence of the disease.

Dr. Sur's Scheme for the Prevention of Infection of Mosquitoes.

There are two main factors in the causation of malaria: (1) The presence of the carrier mosquitoes, and (2) the germ-carrying patients.

In the past, with the exception of somewhat haphazard distribution of free quinine, anti-mosquito campaigns have been the only methods of malaria control adopted in the Province.

It was realized that, whereas methods of mosquito eradication might be practical in densely populated areas where drainage and other sanitary schemes were already in force, it was not feasible in the wide tracks of thinly inhabited agricultural and jungle country.

If malaria is stamped out amongst the human carriers, it matters little if the mosquitoes are present or not, and Dr. S. N. Sur, Malariologist to the Government of Bengal, formulated a scheme for testing the practicability of this method. The principle of this scheme is mass treatment of the population in a selected rural area, with a view to sterilization of human carriers, anti-mosquito methods only to be a secondary consideration.

Continued dissections of mosquitoes in the Public Health Laboratories in the School of Tropical Medicine, Calcutta, show that during the period from April to June, anopheline mosquitoes remain uninfected in Nature. If, then, a community can be kept free from the sexual forms of the parasite during this period, the mosquitoes cannot later on, in the rainy season, when temperature and humidity are favourable, become infected. It has been shown that, whereas quinine will cure a patient with malaria, it does not sterilize him sufficiently to prevent him infecting mosquitoes. In Dr. Sur's experiment quinine and plasmochin were used—the latter to kill the sexual forms.

A circular area with a diameter of 7½ miles, covering about 44 square

miles and containing 97 villages with a population of 21,409, of which children under 12 form about 30 per cent, was taken up for the purpose of this experiment. The area is situated in the Memari Thana of the Burdwan District, and is highly malarious, having an average spleen rate of about 70.

The area was divided into six divisions, each placed under one Sub-Assistant Surgeon, and had one Central Research Laboratory. Work was commenced in April, 1933, and has been carried on since. Continuous and intensive propaganda was commenced before April, as co-operation by the masses is vital, and a thorough survey made.

The first part of the scheme constituted the distribution of quinine and plasmochin to every person within the area by house to house visit by the doctors. Each adult got fifteen grains of quinine and cinchona febrifuge, in tablet form, a day for five consecutive days and 0·02 gramme of plasmochin for three consecutive days. This distribution was started on April 3 and completed by the last week in June. Out of a total population of 21,409 persons, 20,450 took plasmochin and 17,587 took quinine.

From July 3, centres for the treatment of malaria cases were opened—five in each Sub-Assistant Surgeon's area—and were visited two days a week. Each case of malaria was given fifteen grains of quinine and cinchona febrifuge and 0·02 gramme of plasmochin daily for three days.

At first difficulty was experienced in persuading the population to take the treatment, but propaganda and the assistance of the District Board and Union Boards eventually overcame much of the prejudice. Anti-propaganda by quacks, who saw a very lucrative livelihood in danger, had to be fought.

As it happened, climatic conditions were against the scheme as the months of April and May were unusually wet and consequently mosquito infection commenced earlier.

Progress was very carefully checked by the following means: (1) Sporozoite rate worked out by regular collection and dissection of anopheles. (2) Malaria cases attending the Dispensaries were checked against the figures for Local Dispensaries in previous years. (3) Parasitic index was determined by random sampling and examination of blood films month by month both inside and outside the experimental area. (4) Gametocyte rate was also worked out both inside and outside the area. (5) Spleen index and average spleen were taken.

The cost of treatment per head of population was As. 5 for medicine and As. 4·72 for the campaign. The total expenditure by the Bengal Government was Rs. 20,000/- and, as large stocks of quinine, cinchona febrifuge and plasmochin still remain in hand, only Rs. 1,000/- for euquinine for the treatment of children, Rs. 5,000/- for quinine and Rs. 5,000/- for plasmochin will be required to complete the experiment next year.

Up to date, results have been encouraging and prejudice against the

drugs is dying out; in fact they are becoming popular. It is too early to give an opinion and final results at the end of next year will be of great interest.

MR. GRIFFIN'S IRRIGATION SCHEME.

The question of improving irrigation and drainage by opening up old waterways and reverting to the natural tidal method of land reclamation has been taken up by Mr. F. C. Griffin, Chief Engineer to the Department of Public Health, who is also a member of the Drainage Committee.

Mr. Griffin has studied the problem in detail; old maps and plans going back as far as 1760 have been consulted and each area has been carefully considered, and, where necessary, levels, etc., have been taken. A large-scale working model relief map has been prepared, and from this the action of tides, monsoon flood water, rain storms, silting of rivers, etc., can be studied. As far back as fifteen years ago, Mr. Griffin carried out three experimental anti-malaria schemes—Meenglas Tea Estate, Singaran Colliery and Jangipore.

The District of 24 Parganas and Calcutta have been considered recently. Separate schemes have been drawn up for each area in such a way that each scheme dovetails into those adjoining, eventually to make a corporate whole. The reason for this is that the expense will be borne by the local bodies concerned and paid for by them out of their own funds assisted by loans from Government.

Mr. Griffin has embodied in his schemes not only drainage and land reclamation, but, where necessary, town planning, water supply and sewage disposal systems.

Plans and estimates have been prepared for the improvement of the Bidyadhari River to provide efficient sewage disposal and drainage for Calcutta and for making the Salt Lakes tidal. A further scheme has been completed for the provision of drainage of the land North of Calcutta in the Khamarhati Municipality. This will include town planning and a water-borne sewage system on the activated sludge principle as well as an efficient water supply obtained by utilizing as reservoirs the large borrow pits made in the construction of the Calcutta Chord Railway. In addition, streams and rivers in the rural portions of the area will become tidal.

Further schemes are in course of preparation and in the Bhatpara Municipality—twenty-four miles north of Calcutta—a project embodying all the improvements noted above is in course of being carried out.

In future it is hoped to extend the work to larger areas of the Province, but it will necessarily be slow, as many natural "spill areas" have been reclaimed by the embankment method and are now occupied and under cultivation. Each area has to be carefully worked out so as to cause as little disorganization of existing arrangements as possible.

TANKS AND BORROW PITS.

In urban areas and in cantonments where there is an efficient piped water supply, tanks are merely a menace to health. Their only use is as

a source of revenue to the authorities concerned by sale of fishing rights. In most cases the form of lease issued contains rigid clauses binding the lessee to keep the tank clear of weed and to have straight cut, clean edges. In addition the tanks are sprayed with Paris green which, in the dilution used, three per cent, does not injure fish or render the water unfit for consumption by human beings or animals. In a number of cases tanks are being filled in with bazaar and street refuse, and, where available, with cinders from mill furnaces. This method has been found very satisfactory; there is very little smell or fly breeding, and when the tank has been filled the land has a high manurial value and can be let advantageously as agricultural land, thus more than compensating for the loss of revenue from fishing rights. This land cannot, however, be let for building under fifteen years because it tends to settle about thirty per cent in that period.

In villages in the rural areas the problem is not quite so easy because these tanks form the only water supply for the community; but this is all the more reason why they should be kept free from weeds, etc.

Railway and road borrow pits are being dealt with by the authorities concerned, chiefly by clearing weeds, cutting bunds, and making drainage where possible.

In all cases of tanks and borrow pits energetic propaganda is being pursued—mainly through the Co-operative Anti-malaria Societies—to stock these with larva-eating fish, of which a number of varieties exist in Bengal. Application has been made to the railways to allow special facilities and rates for the carriage of the fry of these fish.

Propaganda is the only weapon available against the indiscriminate erection of fishing bunds and the cutting of bamboos between joints. Some success has been attained.

Anopheles Ludlowii.

The menace to Calcutta of the *A. ludlowii* is very real and the gravity of the situation is realized by the Government of Bengal. A special Ludlowii Sub-Committee has been formed and is doing good work. At present its chief duty is to carry out a complete survey, but in addition it has made certain recommendations; for instance, it proposes that country boats bringing in rice straw should be made to pass through a fumigating station to kill adult mosquitoes.

In addition to a survey, which is very thorough, all new breeding places found are immediately dealt with by the usual methods—oil, etc., and controlled. It is hoped that Mr. Griffin's new drainage schemes will go far towards solving this problem.

The Position in North Bengal.

As previously stated, large firms are doing a great deal of work on their tea estates, but are hampered by conditions in surrounding areas. A scheme to enforce intermittent irrigation of crops has been formulated whereby

each "terrace" will be dried up periodically in order to destroy larvæ. A draft Bill has been submitted to Government to give powers to Local Authorities for this purpose.

Conclusion.

Only the very briefest outline can be given in these notes, but full details can be obtained from the articles written by the gentlemen referred to and from the various pamphlets issued by the Public Health Department of the Government of Bengal from time to time.

Enough has been said, however, to indicate the problems confronting the malariologist and the lines on which they are being tackled in a Province larger in area than the whole of England and Wales. An attempt has also been made to show the dangers attendant on haphazard methods pursued without careful preliminary investigation and thought.

Schemes which, in the past, were welcomed as outstanding improvements, have, ten to fifteen years later, proved very much the reverse.

I am indebted to Colonel G. C. L. Kerans, D.S.O., V.H.S., I.M.S., Assistant Director of Medical Services, Presidency and Assam District and to Colonel D. P. Goil, I.M.S., Surgeon-General with the Government of Bengal, for permission to send these notes for publication. My grateful thanks are due to Mr. F. C. Griffin, Chief Engineer, Public Health Department; Dr. R. B. Khambata, Director of Public Health; Dr. S. N. Sur, Assistant Director of Public Health, Malaria Research, and Rai Bahadur Dr. G. C. Chatterjee, for their assistance and advice and of whose writings I have made full use.

Editorial.

REPORT OF THE LISTER INSTITUTE OF PREVENTIVE MEDICINE, 1934.

In the Bacteriological Department of the Lister Institute some very interesting studies on virulence of *Bacillus typhosus* and resistance to "O" antibody have been carried out by Dr. A. Felix and Miss R. M. Pitt.

In previous work on the bacteriological action of serum Felix and Olitzki had shown that strains of *B. typhosus* and *B. paratyphosus* A which are highly sensitive to "O" agglutinins are also highly susceptible to the bactericidal action of serum. From this observation it seemed justifiable to assume that strains of *B. typhosus* of the sensitive type are less virulent than the non-sensitive or inagglutinable strains. To test this hypothesis Felix and Pitt selected the mouse as the experimental animal, as Grinnell, and Perry, Findlay and Bensted have shown that extremely regular results are obtained when mice are used for virulence tests with *B. typhosus*.

It is generally recognized that in primary cultures from typhoid excreta inagglutinable strains of *B. typhosus* may be met with that are "apparent" "O" variants. They are readily agglutinated by anti-"O" sera, and when sub-cultured on agar develop abundant flagella and are then agglutinated to full titre by anti-"H" sera. But as long ago as 1920, Weil and Felix described striking differences between different strains of *B. typhosus* as regards agglutinability by "O" agglutinins. Felix, in a subsequent paper, showed that between types of extreme sensitiveness and extreme non-sensitiveness the difference in agglutinability by "O" agglutinins may be as great as multiples of 10, 50, or even more; that this property is constant in individual strains; and that the well-known Rawlings strain belongs to the sensitive type.

In their experiments with mice Felix and Pitt employed only strains of two types: (1) Extremely sensitive, agglutinable; and (2) non-sensitive, inagglutinable. These were selected by preliminary agglutination tests. Types of intermediate agglutinability, which they state form the bulk of the strains of *B. typhosus*, were not used.

Felix and Pitt found as the result of this work that in the living state highly agglutinable strains of *B. typhosus* are of low virulence, while living inagglutinable strains are highly virulent. Both types of strain, when tested by all the known methods for detecting roughness, were found to be perfectly smooth. There was also no difference in their content of "H" antigen.

If the inagglutinable strains are killed by heat or by treatment with chemicals, the inagglutinability is lost and the suspensions are agglutinated

by "O" serum to the titre limit. It makes no difference whether the "H" antigen is destroyed by the treatment for killing the organisms, or whether it is left intact. The resistance to "O" agglutinins is also suppressed by growing the cultures for twenty-four hours on agar containing phenol in a dilution of 1 : 900; and simultaneously the virulence of the cultures is reduced to that of the avirulent agglutinable strains.

The virulent strains have no capsule; it was thought that the inagglutinability might be due to some capsule or mucoid substance, but the presence of such a substance could not be demonstrated. The toxicity for mice of the killed virulent strains is not greater than that of the avirulent strains. Filtrates from broth cultures and extracts from agar cultures of the virulent strains do not increase the virulence of the avirulent strains nor do they produce any inhibitory effect on "O" agglutination. When suspensions of killed organisms are used for agglutination absorption tests, no antigenic difference is demonstrable between the two types.

Felix and Pitt consider that the results of their experiments clearly indicate that the mere presence of smooth "O" antigen does not completely define virulence. Some obscure property is required to render this antigen resistant to "O" antibody.

The unreliability of smooth characters of a growth of *B. typhosus* as an indication of virulence had been demonstrated by the work of Perry, Findlay and Bensted. They found that when smooth cultures of twelve recently isolated strains of *B. typhosus* were injected intraperitoneally into mice the minimum lethal dose varied from 50 to 200 million organisms. The strains of high virulence, viz., having a lethal dose of 50 millions, were not agglutinated in the living state by T.O. antiserum at 37° C., but when killed they were readily agglutinated by T.O. antiserum at 52° C. The strains with low virulence were agglutinated in the living state by T.O. antiserum at 37° C.; the lower the virulence the more marked was the agglutination of the living organisms. The killed organisms of low virulence were all agglutinated by T.O. serum at 52° C. to a titre similar to that of the organisms of high virulence.

They also described an intermediate strain (A) which had a smooth colonial appearance, was stable in saline and gave a negative reaction with Millon's test and the acriflavine test, and yet the living bacteria were agglutinated by T.O. antiserum at 37° C. to a high titre. The minimum lethal dose of this strain was 100 millions compared with 500 to 600 millions of the original rough Rawlings and 50 millions of the rejuvenated Rawlings.

From this point of view the history of the Rawling's strain, which was used for many years in the manufacture of anti-typhoid vaccine, is of particular interest. Perry and his collaborators found that the original Rawlings gave colonies with a granular surface and irregular outline; it was readily agglutinable in the living state by T.O. serum at 37° C., and the minimum lethal dose was from 500 to 600 million organisms. By certain methods of passage through mice the colonies changed and showed

only a slightly granular surface, the living organism became inagglutinable by T.O. serum at 37° C., and the minimal lethal dose fell to less than 50 millions. When subsequently employed as a vaccine this passaged strain conferred approximately ten times the protection given by the original vaccine.

Perry and his collaborators considered that the greater antigenic value of rapidly passaged strains of the typhoid bacillus might be due to the presence of an antigen elaborated by the interaction of the organism and the body processes.

In further experiments with *B. typhosus*, reported in the July 28 number of the *Lancet*, Felix and Pitt found that the factor rendering smooth "O" antigen resistant to the action of the "O" antibody is itself an antigen separate and distinct from the long-established "O" and "H" antigens of *B. typhosus*. In their previous experiments they had shown that suspensions of inagglutinable or resistant strains when killed by heat or chemicals were agglutinated by "O" immune serum to titre limit and quantitative absorption tests with standardized suspensions showed that sensitive and non-sensitive strains did not differ in their content of the smooth "O" antigen. Furthermore, in rabbit immune sera prepared by inoculation of inagglutinable strains killed by heating at 60° C., no residual agglutinins for the homologous strain were demonstrable when the "O" agglutinin had been removed by absorption with an agglutinable strain. These results seemed to justify the statement previously made that the two types of strain did not differ in their antigenic composition.

In their latest work Felix and Pitt prepared vaccines of suspensions of twenty-four-hour agar cultures of inagglutinable smooth and agglutinable smooth strains, standardized by opacity and killed by heating for one and a half hours at 58° C., and injected them into mice. Twenty-four days later a test dose of 2 M.L.D. of their most virulent inagglutinable strain was inoculated intraperitoneally. Of 20 mice vaccinated with the inagglutinable strain 15 survived in one experiment and in another 17 out of 19 mice survived. But of 22 mice vaccinated with the agglutinable smooth strain only 1 survived. Control normal mice were all killed by the test dose. These results correspond to the findings of Perry and his collaborators with the original and the passaged Rawlings strain.

It was clear from these experiments that vaccines prepared from inagglutinable strains heated to 58° C. conferred a high degree of protection, whereas vaccines from agglutinable strains similarly heated were almost devoid of protective action. Felix and Pitt consider that their protection experiment indicates the presence in the inagglutinable strains of a separate antigen which withstands heating to 58° C. They demonstrated the presence of this antigen by agglutination experiments. Immunization of rabbits with living organisms of three inagglutinable strains and two intermediate strains, Watson and Mrs. S. (this strain was used by Ledingham and Arkwright in their experiments and is said to represent

the most common type of *B. typhosus*), led to the production of an antibody which is absent from the sera of rabbits inoculated with living agglutinable organisms or inoculated with heated suspensions of virulent inagglutinable strains. Felix and Pitt propose to designate the new antigen as the "Virulence Antigen" and to refer to it as the Vi. antigen.

The Vi. antibody is capable of clumping the inagglutinable strains, whereas the "O" antibody is unable to produce this effect. The macroscopic appearance of the Vi. agglutination is very similar to that of "O" agglutination. Small granules of uniform size are formed which settle slowly and leave the supernatant fluid clear. The titre of the antibody is low; the highest Vi. titre observed was 1 : 400.

All the virulent strains reacted with all the sera containing the Vi. antibody, and the intensity of the reaction showed a definite relationship to the degree of virulence. Absorption tests showed that the living organisms of the highly agglutinable type of *B. typhosus* were unable to reduce the Vi. titre. All the inagglutinable strains tested removed the Vi. antibody readily, irrespective of whether the "O" and "H" agglutinins had been simultaneously removed or reduced. Experiments on the neutralization of the so-called endotoxin of *B. typhosus* indicated that "O" antibody has a definite neutralizing effect on the endotoxin, but Vi. antibody is incapable of this action.

The new antigen and its corresponding antibody would thus appear to be mainly concerned with the reactions that inhibit tissue invasion.

Felix and Pitt consider that in anti-typhoid inoculation the Vi. antigen must be taken into consideration and that to ensure the maximum efficacy of the vaccine the strain or strains selected must have the highest possible content of the Vi. antigen, in addition to the normal quota of "O" antigen. In this connection it is interesting to note that for some months the vaccine manufactured at the Royal Army Medical College has been prepared from strains of typhoid and paratyphoid organisms conforming to the types indicated.

Felix and Pitt also believe that serum containing both the Vi. antibody and the "O" antibody will prove to be of value in the treatment of typhoid patients.

Work on the cultivation of vaccinia virus on artificial media has been continued by Dr. Eagles. In cell-free fluid media he has completed a series of passages in which the washed elementary bodies obtained from deposits of Berkefeld V filtrates of dermal virus centrifugalized at high speed were used for the initial seeding; kidney extract, prepared by grinding, salting and high speed centrifugalization, constituted the culture medium. Seven generations of subcultures have been carried through without apparent loss of potency, the final subculture representing a multiplication of 20 times the original potency of the seeding as judged by animal titration.

Workers in other countries have not succeeded in securing evidence of growth of vaccine virus when cultivated in cell-free media, and Dr. Eagles

and Dr. Sabrin, U.S.A., are now working in conjunction in an effort to explain these conflicting results.

Dr. Eagles has inoculated washed elementary bodies from centrifugalized filtrates on a solid cell-free medium consisting either of chicken embryo or solid adult rabbit-kidney stiffened by the addition of hen plasma and a small amount of agar. No growth appeared on the surface of the inoculated medium though active virus could be obtained by surface washing up to seven days after inoculation.

Suspensions of elementary bodies, derived from filtrates of dermal virus by high-speed centrifugalization, are stated to possess high activity. As they represent the virus in the purest form and are sterile, and can be prepared with ease and economy, an investigation of their activity is being made under various conditions of storage. The survival periods of these suspensions in a medium of simple broth compare very favourably with those obtained with crude pulp in saline or glycerol saline.

Varicella and herpes zoster have for some time been considered to be related, and now it appears that Paschen has found elementary bodies similar in size and staining to those of vaccinia and varicella in the vesicle fluid of early skin lesions of zoster. Dr. Amies has obtained pure suspensions of the elementary bodies of herpes zoster by high-speed centrifugalization of the vesicle fluid. These suspensions are agglutinated by the serum of the convalescent zoster patient. This serum also agglutinates the elementary bodies of varicella to approximately the same titre. In a few cases varicella convalescent serum has also been found to agglutinate both varicella and zoster elementary bodies. The belief that the two viruses are closely related seems to stand now on a scientific basis.

A virus (*B. virus*) has been recovered by Dr. Sabin from a fatal case of acute ascending myelitis in New York which is readily communicable to rabbits by intradermal injection, and produces in them an ascending paralysis accompanied by necrotic foci in certain viscera similar to those associated with highly virulent vaccinia and herpes infections. The virus in the rabbit brain and cord is very active, and a 1 : 5,000 dilution of a ten per cent highly centrifuged brain and cord emulsion produces paralysis and death after intradermal injection though the skin lesions may be minimal or almost imperceptible.

The *B. virus* is filtrable through Berkefeld V and N candles, and high-speed centrifugalization of the filtrate has yielded a highly potent sediment and a supernatant fluid entirely free of virus. It seems evident, therefore, that *B. virus* contains elementary bodies, and further investigation of its relation to vaccinia and the herpetic group of viruses is being actively pursued by Dr. Sabin at the Lister Institute. He has succeeded in infecting a rhesus monkey with rabbit virus by intracerebral and intraperitoneal injection, the animal showing marked paresia on the second day, followed

by death on the third day. The brain and cord from this monkey were infective for rabbits, producing a large hæmorrhagic skin lesion, ascending paralysis and death.

In 1931 standards for vitamins were adopted, and for the past three years workers at the Institute have investigated the following subjects: vitamin A, pure crystalline carotene as a standard and the influence on stability of the solvent used; vitamin B, the stability at different temperatures of the standard absorption product on acid fullers' earth from rice polishings; vitamin C, suitability of pure ascorbic acid as standard in place of the fresh lemon juice previously recommended. A specimen of coconut oil was found to be the most satisfactory solvent for use with crystalline carotene. Recent researches have shown that there are several isomeric forms of carotene. It has been found that pure β carotene dissolved in coconut oil has a deeper yellow colour and is biologically more active in a somewhat smaller dose than the sample used as the International Standard.

Miss A. M. Copping has shown that copepod material, received from the Marine Station at Plymouth, has a relatively high vitamin D content. The dried material has been found to contain much more than 0·25 unit vitamin D per gramme. This explains the rich deposit of vitamin D in the liver of the codfish, which is stated to feed largely on copepods at certain seasons of the year.

The examination of plant material for vitamin D has shown that the vitamin which is abundantly formed when fresh green leaves are exposed to powerful ultra-violet irradiation tends to disappear when the material is kept, the rate of disappearance depending on the temperature. No evidence was obtained of the presence of vitamin D in germinated wheat, contrary to the statements of some workers that cereals develop vitamin D as well as vitamin C in the process of germination.

At the request of the Accessory Food Factors (Vitamins) Committee, the potency of ascorbic acid in relation to the vitamin C standard of lemon juice has been evaluated. It has been found that the activity of 1 milligramme of ascorbic acid is equivalent to 20 to 30 international units (2 to 3 cubic centimetres of lemon juice).

Maize and wheat proteins in relation to the ætiology of pellagra have been investigated by Mr. Hutchinson, working with Dr. Chick; he has now completed his researches on the relative value of wheat and maize proteins for supporting the growth of young rats. In the diets used, wheat and maize proteins respectively formed the sole source of nitrogen, and, when comparison was made only between experiments which correspond exactly as regards the amount of protein and calorie intake, the value of wheat protein was found to be only slightly superior to that of maize protein. The difference was so small as to be of doubtful significance.

This work does not support the theory that endemic pellagra associated with the use of diets containing maize as the staple cereal can be explained by an amino-acid deficiency in such diets.

The association of pellagra with supposed toxic substances in maize has been investigated by Dr. Chick, Mr. Prunty and Miss Copping. They showed that rats and mice could be reared on diets in which ninety per cent of the calories was derived from maize products without the occurrence of any toxic symptoms, nor were any deleterious effects noticed when the animals consuming these diets were exposed to ultra-violet or visible light from artificial sources.

The toxic acid substance separated from maize by Stockman has been prepared from maize by Mr. Prunty and tested on animals. Only rarely were the paralytic symptoms described by Stockman observed, although large doses (0·5 to 2 milligrammes per gramme of body-weight) were given subcutaneously and intravenously to mice and frogs.

Clinical and other Notes.

CLIMATIC BUBO AND ITS TREATMENT.

By Major R. H. C. PRYN,
Royal Army Medical Corps.

Recent research has focused attention on this troublesome condition, so well known to military medical officers who have served in the great seaport cities of the East. Though much has been written on the pathology of the disease, the treatment of the complaint has not received the same amount of attention, and the standard textbooks on tropical diseases dismiss the subject very briefly.

My excuse for publishing this paper is the hope that my experience in the treatment of the condition may be helpful to other officers, especially those to whom the disease is a novelty.

Pathology.

Climatic bubo has been definitely identified as being the same condition as that described by Durand, Nicolas and Favre in 1913 as lymphogranuloma inguinale in temperate climates. We are indebted to the researches of Frei in 1928, Hellerstrom and Wassen in 1930, and Marshall Findlay and Levaditi in 1932 for establishing this identity.

The organism is ultra-microscopic and filtrable, and the infection can be passaged in monkeys and guinea-pigs. The serum of convalescent patients is protective for both conditions. Frei has elaborated an intradermal test by which the condition can be diagnosed, and which gives positive results in both conditions. By this reaction he has also proved that the affection known as "Chronic Elephantiasis and Ulceration of the Vulva" and other similar cases with associated infection of the rectum and anus, causing a chronic inflammatory stricture (the "Esthiomene" of Hugier), are manifestations of the same disease.

The portal of infection is usually in the genital area, and the disease is definitely a venereal disease, though doubtless it may sometimes be contracted innocently in the same way as syphilis. Extra genital infection with enlargement of glands in the drainage area of the primary lesion has been described.

The histology is as follows: Section of the glands in the early state of invasion shows clumps of macrophage cells and a few giant cells. Later these cell clumps necrose, are invaded by migratory cells forming micro-abscesses, which coalesce into larger ones.

At a later stage the normal glandular tissues are entirely replaced by inflammatory tissues consisting of young fibroblasts and a polymorphic cellular infiltration, which is replaced in the final stages by fibroid tissue.

Symptoms and Clinical Cause.

The patient usually presents himself with a rubbery indurated enlargement of the inguinal or crural glands. The swelling is not particularly painful and there may be little tenderness. The primary lesion is not usually apparent, but occasionally there may be a slight frænal tear, small papule, herpetiform patch, abrasion, or even a definite ulcer, usually in the coronal sulcus, and I have frequently obtained a discharge containing pus cells on prostatic massage. A venereal history is not always obtained, as disciplinary measures tend to make the soldier secretive on this point unless he is cornered with one of the officially recognized "bad disorders."

As a rule, in my experience, there are no constitutional symptoms, but in about one case in seven in China there is an irregular fever, suggestive of a mild paratyphoid infection, and the resemblance is further increased by the mild leucopenia with occasional splenic enlargement and bronchitis which is present. Incidentally I note that Nicolau describes a mild leucocytosis, but I certainly have not found this to be the case when fever is present. If the fever lasts for any length of time a well-marked anæmia is apparent.

This type of indurated enlargement may progress no further, and if untreated may last for many weeks or months. It is usual, however, for untreated cases to progress to suppuration, and here my experience is again opposed to the textbook descriptions which state that suppuration is not the rule. If the abscess is inadequately opened or allowed to burst, especially if it is opened by an incision parallel with the fold of the groin giving inadequate drainage, extensive undermining of the skin and soft tissues results, with fistulous tracts and typical bridges of soft tissue entirely surrounded by skin.

The infection may also spread to the deeper groups of glands and deep abscesses result. Occasionally extensive phagedenic ulceration is encountered. I well remember a case sent home from the West Indies in which an extensive, foul phagedenic ulcer had involved nearly all the skin of the abdominal wall and had tracked into the perineum opening the scrotal sac on one side.

The ultimate prognosis of the disease is good; I have never encountered a death from this condition, though, doubtless, some of the complications may be fatal. The complaint has been a cause of prolonged hospitalization in the past, however, and it still presents a problem.

Treatment.

The treatment varies according to the stage in which the disease is encountered and will be described accordingly.

(a) *Stage of Indurated Enlargement without Suppuration.*

It was formerly the custom to excise the glands when encountered at this stage. Primary union is by no means always attained, however, and the infection occasionally spreads into the deeper glands following this

procedure. Troublesome œdema of the legs also results when the lymphatic chain is too radically dealt with. For these reasons, I consider that this method of treatment should be discarded.

The treatment which I adopt is by protein shock with intravenous diluted T.A.B. vaccine, a treatment first practised by Hanschell. The vaccine prepared in the laboratories of the Royal Army Medical College is diluted to give 300 million organisms per cubic centimetre. The course is started with 150 million organisms in the apyrexial cases, and 75 million in those with definite pyrexia. Injections are given at intervals of four days, and the dose is increased according to the febrile reaction obtained, a temperature of 101° to 103° F. being aimed at.

I supplement this treatment by occasional gland puncture. A ten cubic centimetre or twenty cubic centimetre record syringe is used and the needle is thrust through the long axis of the mass of swollen glands and withdrawn, strong suction being maintained meanwhile. By this means, a small quantity of blood-stained serum is aspirated and this has the effect of lowering the tension in the gland capsule and limiting the spread of necrotic areas. The response to this treatment is frequently remarkable. I have seen the adenitis completely resolve in ten days and it is usual for the fever to be aborted after one puncture. Other cases are more resistant and I usually find that in those cases in which fever has been present the adenitis takes longer to resolve.

(*b*) *Stage of Periglandular Suppuration.*

Treatment by protein shock is continued, but is supplemented by repeated aspiration of the pus and injection of ten per cent iodoform emulsion. In some cases where the abscess is on the point of bursting, it pays to open it, scrape away the obviously necrotic areas of glandular tissue, purify it with pure carbolic acid, and pack the resulting wound with B.I.P.P. ribbon, which is renewed at five-day intervals until healing takes place. If the abscess is opened in this way, it is essential that the incision should be made at right angles to the fold of the groin to ensure free drainage, otherwise sinus formation may result. Healing of the wound with resolution of the glandular enlargement takes place in about three to five weeks.

(*c*) *State of Sinus Formation and Spreading Ulceration.*

When sinus formation has taken place, a thorough revision operation must be undertaken. All bridges of soft tissues and undermined skin are excised, the old abscess cavity is laid thoroughly open, the main incision being planned at right angles to the groin, unhealthy granulation tissue is scraped away, pure carbolic acid is applied and the wound is packed widely open with B.I.P.P. ribbon.

My experience of the extensive phagedenic cases is limited to the case noted above. The liberal application of pure carbolic acid was probably

advisable to stay the ulcerative process, and, after various other applications had been tried, the application of a solution of ten per cent ichthyol in glycerine, finally placed him on the high road to recovery, after which he was invalided from the Service and I lost sight of him.

Average Duration of Treatment in Cases Treated by Protein Shock With or Without Aspiration.

The average duration of a series of cases treated by these methods at the British Military Hospital, Hong Kong, was forty-four days. This may be regarded as an advance on previous methods so far as China is concerned. In my experience the disease is severer and more resistant to treatment in China than in India. I treated a large number of cases contracted in Calcutta and Rangoon from 1924 to 1930, and noted that early suppuration was the rule and febrile cases were very rare indeed. These cases were treated by the incision and B.I.P.P. method and early resolution and healing was always attained. The Indian cases thus presented a contrast with the late suppuration and frequent general symptoms of the Chinese cases. I have little doubt that large numbers of these Indian cases would have been aborted at an early stage if protein shock methods had been practised.

Specific Treatment.

Recently, cases of lymphogranuloma inguinale have been treated with success by injections of the serum of convalescents. Kalz and Sagher in Prague describe the treatment of thirty cases by this means. The average duration of treatment was six weeks, the serum being given at four-day intervals in average doses of ten cubic centimetres, and total doses being 60 to 150 cubic centimetres. I have no experience of this treatment, and it seems impracticable and hardly justifiable to obtain serum from convalescents when almost equally good results are obtained by other means. There is a case, however, for research into the production of a suitable animal serum.

A promising line of treatment by the intravenous injection of pus antigen, diluted 1 : 4 with saline and sterilized by heating at 60° C. for one hour on three successive days, is described by Gay-Priesto. The dose is 0·2 cubic centimetre to 1·6 cubic centimetres at two to four day intervals according to reaction. Major W. E. Tyndall, M.C., D.A.D.P., China Command, is kindly preparing this antigen for me, and I hope to try this method of treatment shortly.

The account of the recent researches into the pathology and treatment of climatic bubo has been largely extracted from synopses published in the *Tropical Diseases Bulletin* and *British Medical Journal.*

My thanks are due to Colonel R. A. Bryden, D.S.O., A.D.M.S., China Command, and Major S. D. Reid, Officer Commanding, British Military Hospital, Hong Kong, for permission to forward this paper for publication.

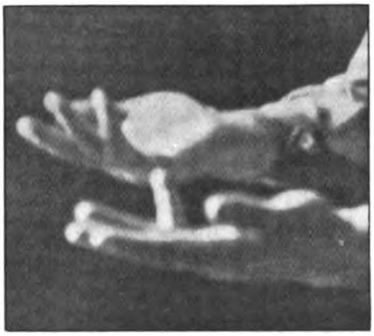
AN ACCOUNT OF TWO CASES WITH PRESSURE SYMPTOMS REFERRED TO THE BRACHIAL PLEXUS.

By D. W. SMITHERS, M.B., B.Chir.,
Civilian Medical Practitioner,

AND

R. M. YEO, M.R.C.S., L.R.C.P.,
Civilian Medical Practitioner.

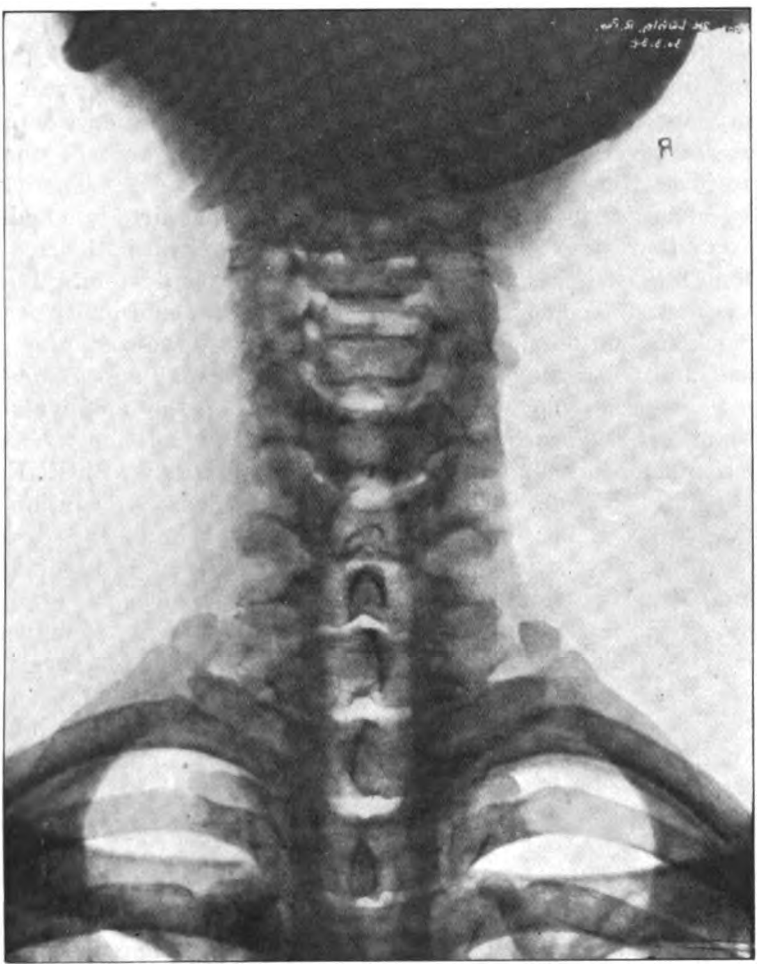
Pressure on the brachial plexus by a cervical rib or by a fibrous band extending from the end of a rudimentary cervical rib is not uncommonly met with and a full account of the condition was given by the late Sir Percy Sargent [1] under the title "Lesions of the Brachial Plexus Associated with Rudimentary Ribs." That symptoms due to pressure on the first dorsal nerve-root might be produced by an apparently normal first rib was first suggested by Bramwell [2], 1903, in an account of a case showing pressure symptoms but with no signs of a cervical rib. Later Bramwell and Dykes [3], 1921, published a case in which Sir Harold Stiles removed a portion of a first rib presenting a normal appearance, the operation being



followed by complete relief of pain and gradual improvement in the motor paralysis. They stated that since then Sir Harold Stiles had carried out the operation in several cases with satisfactory results and took this as proof that pressure symptoms might be caused by an apparently normal first dorsal rib. They divided the causes of pressure symptoms referred to the brachial plexus into three groups: those caused by a cervical rib, those caused by a rudimentary first dorsal rib, and those caused by a normal first rib. The following case appears worthy of record in view of the fact that it does not fall into any of the above three classes and there appears to be no previous record of a similar case. The condition here was apparently caused by an unusual and abnormal condition of the epiphyses of the transverse processes of the first dorsal vertebra, consisting in complete absence of union and producing pressure on the first dorsal nerve-root.

The patient, aged 31, a large heavily built man came to hospital on

account of a bilateral deformity of his little and ring fingers that interfered considerably with the use of his hands. He had first noticed "stiffness of the fingers and poor circulation" in the left hand fourteen years previously when aged 17, shortly before enlistment in the Royal Field Artillery. A year later he found that he was unable to straighten his little finger and that a similar state of affairs was developing in his right hand as well.



CASE 1.

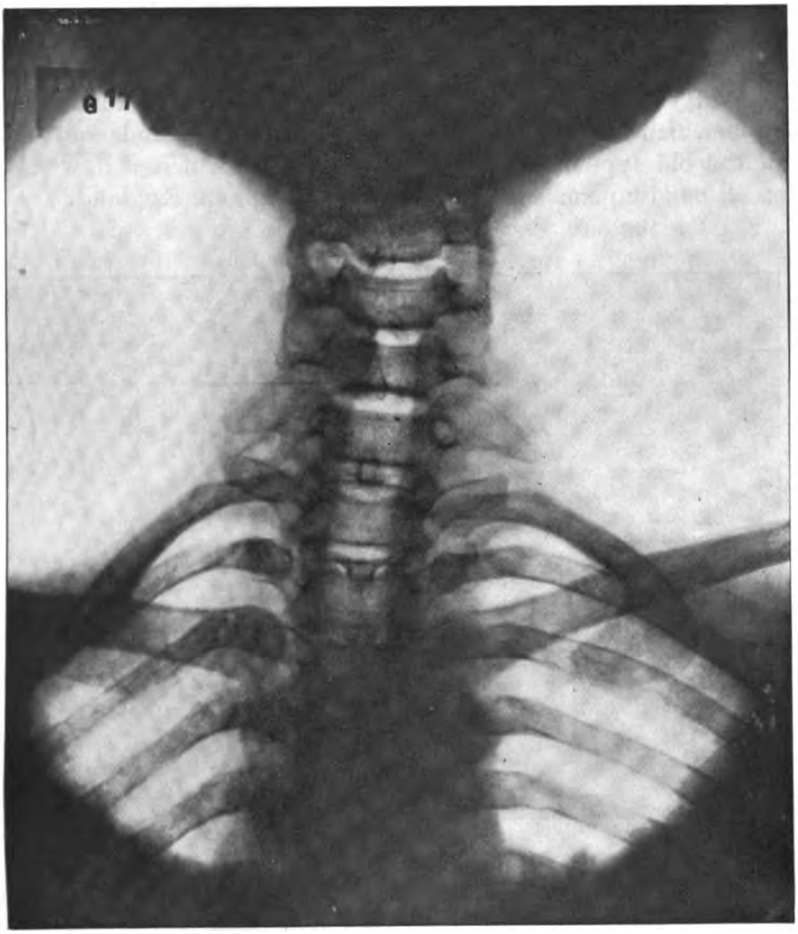
From the onset the condition became steadily worse, the right hand following the course set by the left until he had to be excused from carrying his rifle. He completed twelve years' service, there being no reference to his disability on his transfer to the army reserve or on his re-enlistment in the Royal Fusiliers five months before his admission to hospital. During the past four years numbness and tingling developed in the fingers of both

hands and from time to time he suffered from attacks of pain during which his hands became very cold and blue. As the lesion progressed his hands became more and more useless. When examined it was found that the little and ring fingers of both hands were held in a semi-flexed position and could not be fully extended, actively or passively. Both hands were cold and rather blue. In the absence of a normal side for comparison slight degrees of muscle wasting were difficult to estimate but the hypothenar eminences on both sides appeared to be flattened. The fingers could be flexed fully but other movements were difficult and limited, abduction of the fingers from the mid-line being impossible. Tactile, and thermal sensibility and sense of pain were absent over the inner side of both forearms and over both little and ring fingers, the area of anæsthesia spreading over the middle finger also on the left side. There was no muscle weakness or wasting in either arm beyond that already noted and no œdema on either side. Tendon reflexes were brisk in both arms and no other abnormality was found in the central nervous system. The radial pulse was normal and equal on the two sides. No abnormality was noted in the neck and no cervical rib was palpable. Nerve-root pressure was suspected and a radiogram showed an abnormal appearance of the transverse processes of the first dorsal vertebra, the epiphyses having failed to unite and appearing as separate entities articulating with the first rib on either side. The patient was seen in consultation by Sir E. Farquhar Buzzard, Bt., K.C.V.O., M.D., F.R.C.P., who advised operation on the right side with further operation on the left should the first prove successful, but the patient persistently refused any form of operative treatment, and was invalided as unfit for military service.

While this patient was in hospital another patient in the same ward, also in the Royal Fusiliers (aged 18, with five weeks' service), recovering from acute bronchitis, complained of pain radiating from the shoulder down the centre of the right arm and also of weakness of that arm. No abnormality was found, no definite muscular weakness was noticed and the patient was discharged, all signs of his bronchitis having disappeared. Two months later he was readmitted complaining that the pain was more severe and that on return to duty his right arm had become weaker so that he was unable to manage his rifle. A more careful history was taken and it transpired that when aged 9 years he had developed considerable swelling of his right hand for twenty-four hours, and since then he had noticed "pins and needles" in both hands from time to time, particularly when raising his arms above his head. For two years before his enlistment in March, 1934, he had been employed lifting heavy weights and carrying heavy crates on his right shoulder without any symptoms. Slight but definite muscular weakness was found in the right arm, the hand grip on the right side being weaker than on the left. There was no appreciable muscle wasting and all movements were full; tactile and thermal sensibility, and sense of pain were undiminished. The right hand felt colder

than the left, but the patient himself had never noticed that either hand felt cold at any time. A radiogram revealed the presence of cervical ribs more marked on the right side.

It is of interest that in this case definite symptoms of pain and weakness were not produced after two years of carrying heavy weights on the right



CASE 2.

shoulder, but appeared after one week in bed with acute bronchitis, and resulted presumably from a loss of muscle tone.

We are indebted to Colonel W. Benson, D.S.O., Officer Commanding Queen Alexandra Military Hospital, Millbank, for permission to forward these notes for publication, and to Major H. E. Yorke, M.C., R.A.M.C., for his X-ray reports.

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[2] BRAMWELL, E. *Rev. of Neurol. and Psychiatr.*, 1903, i, 236.
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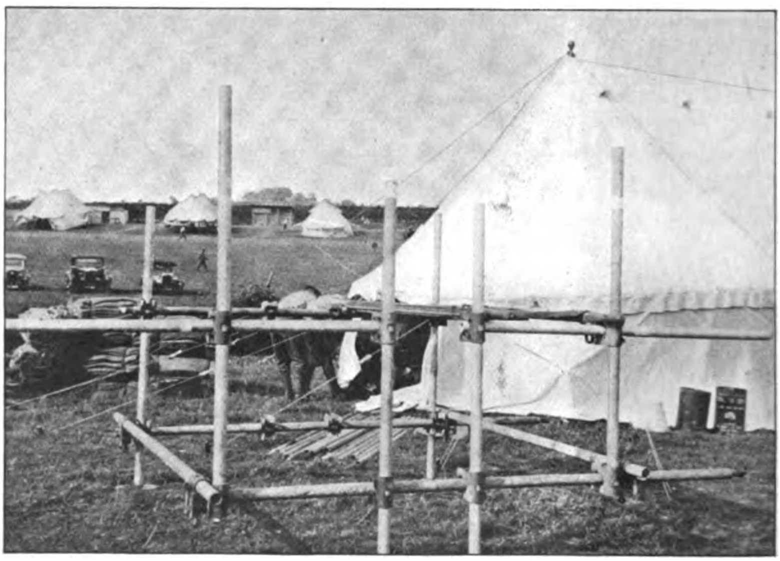
METHOD OF EMERGENCY CONVERSION OF LORRIES INTO MOTOR AMBULANCE CARS.

By Lieutenant (Quarter-Master) R. D. BALLARD,
Royal Army Medical Corps (*T.A.*).

In connection with the ever-present problem of emergency transport of sick and wounded stretcher cases when a shortage of ambulance cars arises, experiments have been conducted with a view to utilizing the metal scaffolding which is now commonly used by builders and contractors in place of the old type of wooden scaffolding, and which is now a familiar sight on all building constructional works throughout England.



The material in question consists of hollow metal tubes of varying lengths which are fastened together by a clip for which a special locking tool is supplied. The tubes can be joined up in any position, and a strong structure, extremely rigid and capable of standing very heavy strain, obtained.

As will be seen from the photograph, a structure suitable for converting a lorry into a carrier for four stretcher cases can be extemporized in a very short space of time, and, if insulating pads made from old motor tyres, etc., are added as shock absorbers, the patients could be carried in reasonable comfort for quite long journeys.

It is suggested that consideration might be given to a supply of tubular scaffolding, locking clips and fastening tools, being made part of the

equipment of baggage and supply lorries with divisional baggage and supply companies. The equipment, when not in use, does not take up much room, and in emergency might be very valuable indeed, particularly in cases when, as occurred recently during field training, a number of men are incapacitated by sudden illness.

It may be added that the scaffolding was also found most useful in providing storage room in Quartermasters' stores under canvas. Blankets can be stacked in large quantities on a rack easily fixed up, and this is greatly preferable to these being piled on table tops or tarpaulins as air can circulate, and blankets, clothing or stores be kept in much better condition and ready for immediate issue.

This note is submitted with the approval of the Officer Commanding 140th Field Ambulance, Lieutenant-Colonel J. O. Thomas, M.C., to whom and the former Officer Commanding, Lieutenant-Colonel F. R. Harris, T.D., I am indebted for permission to carry out this experiment and for assistance in the work.

A COT FOR BRITISH FAMILIES HOSPITALS.

By Major L. S. C. ROCHE, M.C.,

Royal Army Medical Corps.

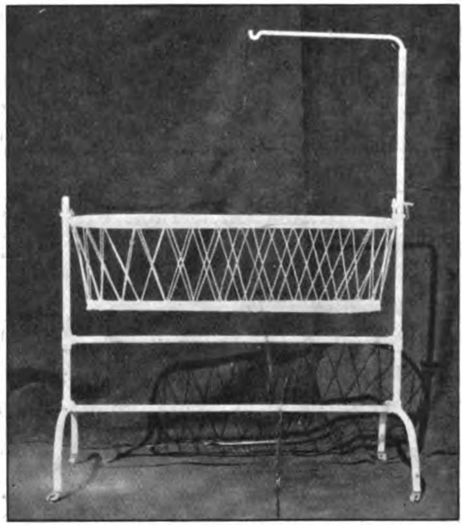
British Families Hospitals in India are provided with maternity wards, labour rooms and maternity beds, but cots for the newly born are not authorized. Such cots can only be supplied from private sources.

In the British Families Hospital at Karachi there existed four folding wood and canvas cots, not very well suited to the damp climate and beginning to show definite signs of fair wear and tear. It was in these circumstances that the cot described in these notes was designed with the following points in view: ventilation, strength and cheapness.

Ventilation was secured by the adoption of an open-work wire cot lightly draped in organdie; strength was assured by building up the stand of iron piping; and cheapness was attained by production of the article in a Military Engineering Services Workshop.

The cot is of very simple construction, which is quite easy to follow from the photographs.

In case other Families Hospitals should require new cots, specifications are given below :—



Measurements are as follows :—

For the stand—

Base	2 ft. 1 in. × 3 ft. 4 in.	
Height of long upright	5 ft.	from ground
Height of short upright	2 ft. 11 in.	from ground

For the cot proper—	
Length	3 ft. 3 in.
Width	1 ft. 7 in.
Depth	11 in.
Height of upper edge	2 ft. 7 in. from ground

Materials required are as follows:—

½ in. galvanized iron piping
½ in. T's (joint fittings)
Brass castors (fitted into wooden plugs)

For the cot proper—
1 in. by ⅛ in. flat iron (for hoops)
No. 12 galvanized iron wire (for sides)

For the mosquito net support—
½ in. iron rod

The cot proper is suspended to the uprights of the stand by bolts and may be prevented from swinging by a pin pushed through the upright and through a plate riveted on to its upper hoop.

The cost of the cot (excluding bedding and draperies) was Rs. 20, which includes materials and minimum labour charges.

I am indebted to Colonel G. G. Tabuteau, D.S.O., V.H.S., for raising the sum necessary to meet expenses and for allowing me to forward these notes for publication, and also to Sub-Conductor H. D. Kingham, M.E.S., for giving me his valuable advice and for undertaking construction in the Military Engineering Services Workshop.

PERNOCTON IN MIDWIFERY.

By Major L. S. C. ROCHE, M.C.,
Royal Army Medical Corps.

The perusal of a report on the use of nembutal by Major J. W. Lane, R.A.M.C., in this Journal last year prompts me to submit some notes on the use of pernocton, another barbiturate, which I have used on 33 of my parturition cases, 21 primiparæ and 12 multiparæ respectively.

Pernocton is a ten per cent solution of the sodium salt of the secondary butyl-B-bromallyl barbituric acid, and is put up in 2·2 cubic centimetre ampoules by the makers, Messrs. J. D. Riedel E. de Haen.

It is administered intravenously at any time after labour has definitely started, viz. when pains are regular and the os is two fingers dilated.

A rough scale of dosage is as follows:—

Weight—125 lb.	4·4 cubic centimetres
125-150 lb.	5·0 ,, ,,
150 lb. and over ..	6·6 ,, ,,

In making the intravenous injections there are two points which must be rigidly observed.

Firstly, the injection must be made slowly at the rate of one cubic centimetre per minute or, better still, one and a half minutes. Any attempt

at speeding up the injection will produce vomiting, jactitation and restlessness.

Secondly, none of the solution must be allowed to infiltrate the surrounding tissues, as the area is liable to slough.

Before and during the injection the patient should be encouraged to sleep.

By the time the injection is finished the patient falls asleep. Contractions cease for a few minutes, then come on as regularly and as strongly as before, the patient tossing about a little and even crying out at the approach of a contraction, then going off to sleep again at its termination. This state of hypnosis and amnesia continues for two hours, or sometimes longer. As the presenting part distends the perineum the influence of pernocton is not sufficient. It is found that the inhalation of very small amounts of ether or C.-E.$_2$ mixture during contractions is sufficient to ensure painless delivery.

If, however, the patient shows signs of coming round before delivery is completed, three courses are open.

(1) If delivery is imminent (i.e. expected within one hour), it is advisable not to repeat the pernocton, as it may lead to fœtal distress and oligopnœa at birth. It is better to complete delivery under ether or C.-E.$_2$ mixture as described above.

(2) If delivery is not imminent, pernocton may be repeated; 2·2 cubic centimetres are administered intravenously at the rate of two minutes per cubic centimetre.

(3) Instead of a repeated dose of pernocton, in eighteen of the cases in this series I have given $\frac{1}{200}$ to $\frac{1}{100}$ grain scopolamine subcutaneously. This appears to be quite satisfactory, but scopolamine should not be given within an hour of delivery as it is very liable to lead to fœtal oligopnœa and asphyxia at birth.

The results as regards hypnosis and amnesia were uniformly good, though the degree and duration of the action seemed to vary considerably in different patients. However, even if the depth of hypnosis was found to be less than that produced by substances such as avertin, it was found certainly greater and less variable than that produced by morphia-scopolamine, and much quicker in action than either substance.

Given with care, there appeared to be no bad effects on the mother. There was but a momentary slowing of pains; there was no delay in the third stage and no increased tendency to postpartum hæmorrhage. Nor was it my impression that the necessity for forceps delivery was increased.

There seemed to be no effect on the fœtus except that slight asphyxia and oligopnœa were noted in a case of somewhat precipitate labour, and in one where scopolamine had been injected very soon before delivery.

Among the thirty-four children born there were three still-births, one in an unreduced occipito-posterior case with forceps, one in an undersized and weakly twin, and one in the case of a short cord wound tightly twice round

the neck causing traction on the placenta. There were two neonatal deaths, one was in an anencephalic monster, the other in a twin delivered by forceps. Both still-births and neonatal deaths occurred in first confinements, and did not appear to be attributable to the action of pernocton.

Pernocton is also a useful basal narcotic in various minor obstetric operations, often without additional respiratory anæsthetic, e.g. in various manipulations or in cases of severe bleeding in incomplete abortion, when rapidity of induction is an important factor. Used in conjunction with ether, it speeds up induction and lessens the total amount of ether used. In this connection I have had a patient ready for a laparotomy incision eight minutes after the stab of the intravenous injection needle.

The impression gained as a result of these few cases was that for producing hypnosis and amnesia during labour pernocton is generally satisfactory; with practice it is easy to administer, rapid in action, and safe to both mother and child.

I am indebted to Colonel G. G. Tabuteau, D.S.O., V.H.S., for allowing me to forward these notes for publication.

Travel.

THREE MONTHS IN KASHMIR VALLEY.

By "UNST."

The Banihal Pass Road commences at Jammu, skirts the Chenab Valley, rises to a height of approximately 9,000 feet at the summit and slopes down to Srinagar, the capital of Kashmir. Here a detailed description would be out of place, but the leisured traveller is well repaid by a few halts with the camera. There are partridge and jungle fowl to be shot, and occasionally chikor and monal on the higher reaches.

Three months' campaigning in an exasperating tangle of foothills, followed by a lengthy incarceration in a mud fort, had induced in me that condition of mild insanity experienced by Europeans in the "shiny" when leave becomes a necessity. The various authorities concerned had agreed to dispense with my services for a period of three months, and the bonnet of my six-cylinder Chevrolet car was headed for Jhelum. My destination was Srinagar, and my route lay along the road already mentioned. I had for some time promised myself a shooting trip after barasingha, the tall, strong-antlered stags (*Cervus kashmiriensis*) which are found in the high, forest-clad hills overlooking the Valley of Kashmir. I desired also to procure a specimen of the Himalayan black bear, which is plentiful in these parts, and, as my leave was taken in the months of October, November and December, I wished to enjoy the small game shooting, of which I had heard nothing but praise.

The journey to Srinagar was uneventful, punctuated by the usual series of minor disasters and hurried excursions with a scatter-gun, which are the lot of every enterprising and inexperienced motorist travelling in India. At one point on the Pass Road I came across a lorry burnt to ashes in spite of desperate efforts which had been made to extinguish the flames with sacks of flour. I tried to cheer the driver, who was brooding on the ruins over a contemplative cigarette, by expressing deep regret that such a catastrophe had visited him, and offering him a lift, but he seemed surprised and a little impatient, as if such consideration in the face of Kismet were unnecessary and rather presumptuous, though he answered with politeness, "Sahib, I can go nowhere, but if at any time I can help you, I am at your service."

The road wound on interminably. From the summit of the Pass there is a view, distant and magnificent, of the Kashmir Valley shelving peacefully to meet the eternal snows. At night I shunned the rest-house, and slept in a wide corrie murmuring with streams, after eating for supper a chikor, bagged early that morning, and now served, excellently cooked, by my old bearer. I felt my holiday had begun.

In the morning I felt cold and stiff, but the lethargy bred in the Plains had vanished, and my pulses were thrilling with the wine-like air of the Hills. To furnish an anti-climax, my car refused to start, and I was in a thoroughly bad temper before the engine spluttered into life, and we coasted into Srinagar.

Here, as I did not intend to wait too long, I made straight for an agent who had been recommended by an experienced traveller of my acquaintance and told him my plans. As I was talking, he produced a shikari, a cook, stores and various other necessities for the trip. Bahar Shah (the agent) is to be thoroughly recommended to every sportsman travelling in Kashmir, whatever his object may be. He seems to be able to produce, at a moment's notice, any desired commodities, and, what is even more important, men who will carry them anywhere. Half-an-hour in his office sufficed to cater for my modest expedition, which was intended to cover no great area of ground, but required a considerable amount of prearrangement, and I left his office for Nedou's Hotel, fully prepared to start next morning.

At the appointed time I was met, near one of the numerous slipways leading to the Jhelum River, by a boatman with his "dunga." A "dunga" is a small houseboat, smaller than the vessel occupied when spending a lengthy stay on the river or lakes, and larger than the "shikara," a sort of covered canoe, dedicated chiefly to romantic expeditions in the moonlight. The "dunga" contains a cookhouse, a combined dining and sitting room, and a bathroom. Motive power is supplied by the "manji" (boatman), who wields a punt-pole in the bow.

The journey from Srinagar to Bandipore was completed in just over twenty-four hours. We landed at Bandipore, a small village on the shore

of the lake, and collected pack transport for the onward march. Wasting no time, we loaded the ponies and struck off along a valley leading towards Haramuk (a mountain some 17,000 feet high—a pleasant mountaineering expedition in summer), passing through some hot and unbelievably dirty villages, buzzing with flies, and ringing with the shrill imprecations of pariah dogs. This part of the journey was exceedingly unpleasant, heat, flies and noise combining to torment the brain and weary the body. Small children emerged from hovels to gaze and weep, squatting villagers obstructed the route with the mild, inactive offensiveness, so perfectly practised by the Indian, dogs cringed howling, and wreaths of acrid smoke assaulted the senses. Presently all this was left behind, and the path, slanting up the hillside, surmounted a low ridge and dropped into a pleasant valley, loud with rushing streams and shimmering with tall poplars. The road led to the heights, and the stream, murmuring in its lower reaches, roared over gigantic smooth-worn boulders and buttresses of primeval rock. Here we left the path, climbing steeply for an hour through pine trees, and emerged on a crest leading to the shoulder of a hill. I carried a gun charged with No. 6 shot, and, in case of accidents in the way of black bear, kept four rounds of lethal in my pocket, but neither load was required.

Leaving the ridge, and crossing the bluff that barred our way, we came upon our resting place for the night, a tiny bungalow on the bank of the stream. The coolies and pack transport arrived, all well and cheerful, packs were off-loaded, animals taken to water and fed, men supplied with cigarettes and small change, and having supervised the "settling-in" process which occurs at the end of every march, I picked up a gun and set off after chikor. I did not get far, being stopped by a game-warden with the news that this very day was the anniversary of the death of an ex-Maharajah of Kashmir, and consequently shooting was forbidden. I returned to the bungalow, and was approached by a native bearing a large earthenware bowl filled with comb honey, a most welcome change of diet. This, with newly baked bread and limitless tea, made a satisfactory meal after the day's march. All the pack ponies were now returned to Bandipore, as I had no further use for them at present. Before retiring I bathed in the crystal waters of the stream, and when the stars rose above the valley and the song of birds died, I slept, with the voice of waters in my dreams.

The camp woke with a bustle, intense activity replacing complete inertia, with no apparent stage of transition, and, almost without realizing it, I had shaken off sleep, drunk a cup of scalding black tea, dressed, and was handling a shot-gun, for the shikari had spotted game near the camp. Even while the coolies were gathering their loads, and the cook impatiently battering out the fire, a bunch of blue-rock pigeon flighted across the stream, giving me a right and left.

This day's march led up through the pines to loftier streams and barer mountain faces, backed by toothed and naked ridges of the higher hills We halted for tiffin near headlong rapids, against a village perched

precariously on a low cliff, and awaited the arrival of the coolies, who bore adequate loads well and cheerfully. Later, we entered a wide couloir, which, rising to a col between twin summits, marked our first camping site, and the end of our march. Here we pitched camp, which consisted of three tents, one shared by my bearer and shikaries, one occupied by the cook and used as a kitchen, and the third for myself, a delightful abode, lined with pushmeena, carpeted with branches fresh cut from the pine, and facing the upper slopes of Haramuk.

Stalking the great stag of Kashmir is a glorious occupation, lasting from dawn till dusk, providing delightful sport in magnificent surroundings: not too strenuous, lacking the grim bleakness of the country in which the great wild sheep are sought, and presenting none of the muscle-tearing acrobatics endured by the hunter of thar and ibex. The country is rarely difficult. A leisurely climb at dawn leads to some vantage point, where, overlooking the forest, waiting for a stag to call or emerge, the greater part of the day is spent, scanning all visible ground through a telescope, watching and listening, basking in the sun or muffled against wind and snow, above deep, far valleys, silver with streams, and sometimes gazing, in rapt appreciation, over a vast, billowing, slowly moving sea of fleecy cloud, through which the great peaks thrust. Before returning to camp at dusk, it is advisable to carry out a short stalk in the neighbouring forest or elsewhere near at hand, searching for recent tracks to be followed up next day, and, perhaps, if Fortune smiles, meeting a barasingh within range. If, during the morning, on the outward march, fresh tracks are encountered, these are followed.

I spent many days, days glorious with sunshine and fresh, washed colours, in pursuit of the quarry, returning to camp pleasantly tired and hungry, to feed hastily and retire early, for the temperature in a high camp after sunset in Kashmir during late October does not encourage leisurely dallying. I made entries in my diary, wrote and read, but mostly from a supine position on a camp bed, fortressed with blankets and poshteens.

There were days when, enchanted with the breathless glory of Nanga Parbat, watching the snowy dome of Haramuk contrasted against the deep blue of the heavens, listening to the far whispering of waters, or dreaming of some half-forgotten memory, I forgot shikar, and drifted through dim halls of reverie.

One morning, while trekking through the forest, massive, great-girthed trees shutting out the sun, pine-needles and turf underfoot, suddenly the air was filled with sound, and numbers of monal, the great pheasant of the Himalayan foothills, the most magnificent game-bird in the world, whirled and rocketed about us. Just then, amidst the great birds, the age-old trees, the diamond air and the pale colours of the hills, I had a vision of a land magnificent and terrible, at present occupied by an inferior race, but destined, in the future, to harbour a new people who will arise when this planet is purged of its present shame.

Stags were scarce. One morning I spotted two, far down the hillside, but they carried poor heads, so I left them, surprising, later in the day, a hind and fawn, which I stalked to within ten yards and attempted to photograph, without success, for the glint of the camera, or some too hasty movement, betrayed my presence, and they fled—but my luck was on the turn.

While I was dozing in the afternoon of a sunny day, after foraging in a well-filled tiffin basket, suddenly my head shikari, wild with excitement, plucked at my sleeve and gibbered. We were situated on a low col overlooking a broad grassy valley, bounded on the farther side by a long, whale-backed hill. Along the side of this hill, right across our front, at a distance of about three hundred yards, a black bear was lumbering at the gallop. Putting up the sights, I sat down to the shot and fired, swinging well in front. The animal gave tongue, not the usual caterwauling ululation, but a deep " hough," just audible, and checked, carrying on again immediately. Swinging still further forward, I pressed the trigger a second time with more vital result, and the quarry came toppling and pitching down the hillside.

Shrieking like madmen, the shikaris and the tiffin coolie hurled themselves down the hillside like errant boulders, although I exhausted my entire stock of bad language and gave myself a sore throat trying to stop them. Certainly the carcase of the bear, caught up in a bush, seen from our side of the valley like a motionless black rock, appeared sufficiently dead ; but I should have preferred a more circumspect approach. My staff, well accustomed to rapid travelling over precipitous ground, outstripped me easily, in spite of my imprecations, and would not wait. The shikari, arriving first, delivered the fallen bear a terrific kick in the ribs and escaped unharmed, for the animal was truly dead. It was a fine trophy, a female of no great size but in perfect coat, and carrying a colossal amount of fat, useless to me, but highly prized by my attendants. My first bullet had hit it far back in the flank and the second had done the business, passing through the neck just behind the base of the skull.

Expeditiously, the carcase was skinned on the spot, the shikari and his helpers scorning my set of new skinning knives and falling to with time-worn implements of their own. The task completed, the skin and skull were rolled into a bundle, placed on the unprotesting shoulders of the already laden tiffin coolie, and taken back to camp, where they were cleaned, well coated with arsenical soap and sent to Srinagar for onward despatch to Messrs. Van Ingen in Mysore, who set them up beautifully, to hang, along with my other trophies, near me as I write these lines.

One bear, but no barasingh ! During the three weeks of my stay I had not seen a really shootable head, though I had followed up fresh tracks time and again, only to lose them in hard ground. I had even tried sleeping out when the moon was full, near a puddled tangle of fresh tracks in the bed of a small nala where stags had been, but never to my knowledge came

again. At this time snow was falling frequently and the weather was bitterly cold, so we shifted camp to a lower level, choosing a sheltered spot in thinly-scattered pine trees near a stream. Snow fell slowly and continuously, stalking being difficult on account of cloud, mist and poor visibility, so that I began to lose hope, but my luck held, and on the twenty-sixth day of my trip a fine head fell to my rifle under peculiar circumstances.

One evening, having returned from a gruelling and unprofitable stalk over a precipitous hillside plastered with scree, after a stag which had belled, and shown for an instant in a far-off clearing, I found my old bearer almost inarticulate with excitement. While I had been away, he said, a large stag had come to graze on the other side of the stream from the camp. We hurried to this spot and found tracks, which disappeared, on being followed, on the crest of a low ridge flanking the stream further down, reappearing some distance away on the edge of a wood, and then losing themselves entirely in some stony ground, showing, with no shadow of doubt, that a barasingh had been, early that evening, within a stone's throw of my tent. This sudden change of events caused me to revise my plans, and I decided, after conferring with the shikari, to stalk next day only till two o'clock, returning about teatime. This scheme was duly carried out, and I was in camp at the appointed hour, waiting and listening, not in vain, for just before dark, from near at hand, the growing silence was broken by a deep bell, the mating call of the barasingh. Picking up my rifle, and accompanied only by the shikari, I stalked slowly towards the sound. Again he belled, from somewhere surprisingly near. Suddenly the shikari grasped my arm and pulled me back behind a tree. He pointed upwards across the stream, and there, against the darkening sky, on the ridge where last night's tracks had vanished, was silhouetted a grand stag. I raised my rifle slowly. It was too dark to see the sights, but I must try. The range was deceptive, but close. I drew a bead as well as I could. There he stood, motionless, but now silent. I pulled the trigger. At that moment I seem to have been smitten with some sort of spell, born of the darkness and my own emotions, for when the stag, instead of falling to the shot or vanishing, stood still, I was incapable of firing a second time. The shikari, now insane with excitement, pummelled my back and even tried to grab my rifle, but I could only stand and stare. Still I did not fire, and still the stag did not move, crowning the ridge, immobile as some dark sculpture chiselled by Pan. Then suddenly he collapsed, and the spell broke. We splashed across the stream, the shikari and I, and panted up to the ridge. Although the last glimmer of light had fled, the shikari sped unerringly to the stricken beast, beating me, as usual, by several lengths, and, despite my warnings and curses in broken Urdu, for I knew what he was after, succeeded in slitting the stag's throat from ear to ear, "hilaling" it, making it lawful Mahomedan food, and incidentally somewhat damaging the head skin. Having reproached him perfunctorily, for I was too pleased

to feel angry at the outrage, I measured the antlers—41¾ inches round the curve with a 6-inch girth and eleven points, a fine head, despite the asymmetry. The spot where the stag had fallen was not four hundred yards from the camp, and I wondered, while my staff arrived with lanterns and much shouting, what had brought him there—memories perhaps of some previous mating, a battle royal fought with some rival in the rutting season, or curiosity caused by the twinkling of fires and the presence of strange creatures, perhaps friendly, who repaid his advances with death. He was borne, slung over the trunk of a young tree, to camp, where the skin and mask were removed by firelight, and the meat apportioned out: how, I do not know, for I received one haunch, and the remainder of the carcase, which was not inconsiderable, had disappeared next morning. My staff, numbering five, could not have eaten it all, although they resembled gorged vultures, so they must have distributed the rest of the prize elsewhere, probably to their villages. The antlers, skull and hide of the barasingh were dispatched to Messrs. Van Ingen, who mounted the trophy excellently.

One month of my leave had gone, and as I had secured two good trophies, I decided to devote the rest of the time partly to shooting monal, with a rifle handy in case of chance encounters with black bear, but the Fates willed otherwise, as will be seen. During the entire period of the monal shoot, which lasted about a week, my total bag of feathered game was one cock, and I encountered such a phenomenal run of luck with bear that I bagged three in four days, as I shall now describe.

The first day after I had shot the stag, I walked over the hills near the camp in the hope of flushing monal or koklass, but drew completely blank. On returning to camp, I put up and shot a solitary snipe near the stream, without changing loads, for at the time I was using an unlined cartridge carrying an overcharge of powder and a small weight of number seven shot, a type of load useful against any feathered game, as it has brought both snipe and greylag to the same bag, but which I abandoned later on, for reasons not worth mentioning.

Next morning, after a late start (my bearer had interpreted my mood, as always, and had brought tea at about seven), we scrambled up a steep, pine-clad hill-side, typical monal country, and were rewarded by finding patches, several square yards in area, of freshly turned earth, where the birds had been very recently scratching for food. The shikari was convinced they were above us, and this was presently confirmed by a series of short, shrill, crescendo whistles coming from further up the hill. We were facing upwards, listening, when suddenly, from a steep, scree-floored couloir on our left, a large covey of monal, headed by two cocks, made downhill, well out of range, much to our disgust. I entered the couloir, and climbed steadily towards the crest of the ridge, carrying my shotgun at the ready, and followed by two shikaris and the tiffin coolie. The ascent was steep, and I was breaking all the rules of hill shooting, keeping my eyes on my

own feet, instead of on the ground round about me, and concentrating my attentions on reaching the top of the hill, instead of watching the neighbouring terrain. Suddenly, with a whistling, clattering whir, a great cock broke cover from well above and in front, speeding right over us, and offering me one of the best shots, high, straight and far, I have ever had: one which I shall never forget. Swinging up my gun, I got him with the right barrel, fairly and squarely, shooting instinctively, as it should be. His wings flickered and sank, his head jerked back, and down he came, crashing into a tree well behind me, and falling to earth at the feet of the tiffin-coolie. This was the first cock monal I had bagged, and I was astounded at the beauty of the plumage, admiring especially the orange tail feathers and the deeply contrasting white inset on the bird's back. He was a big bird, and the shikari, weighing him by hand, judged him to turn the scale at five pounds, which I thought rather an exaggeration, as the average weight of a well-run cock monal varies from three-and-a-half to four pounds.

(*To be continued.*)

Current Literature.

SCHEPEL, J. A. C. Koepokkeninfectie bij den mensch. **[Cowpox Infection in Man.]** *Nederl. Tijdschr. v. Geneesk.* 1934, v. 78, 1855-9. English summary (3 lines).

The importance of recognition of this affection is obviously greatly increased by the abolition of compulsory vaccination before school-attendance age. Cowpox appears to be comparatively common in Friesland, judging by the author's description of two epidemics and of other similar ones. In one of these a farm hand was admitted to hospital with a lesion on the fourth finger, a phlegmonous arm and a mass of glands in the axilla. An ulcer with black necrotic centre was situated near the nail and was surrounded by a violet-red zone extending over the back of the finger. The man was evidently ill and his temperature rose to 40° C. (104° F). His condition improved under fomentation ; the black necrotic centre of the ulcer became detached ; his temperature fell to normal after ten days and no formation of pus occurred either at the nail bed or along the lymphatic vessels. This man was a milker and his employer, a farmer, had thirty-five sick cows, three sick men and a sick maid. Vesicles had developed on the nipples of the cows, which rapidly dried up to form crusts. Another epidemic was present at the same time on a farm three kilometres distant, where there were fifty sick cows and the farmer and some of his assistants had also paronychia and pustules.

The differential diagnosis from cowpox of streptococcal and staphylococcal conditions, foot-and-mouth disease and the so-called "milker's knots" is considered. Prophylaxis for human beings is obviously an

immediate vaccination of all the personnel, but that for the cow is somewhat more complicated. So far as conveyance of the disease from the hands of the milker goes it is a matter of segregation of the first animals affected. But where does the original infection arise? A number of conditions are reviewed and the suggestion is thrown out that "grease" in horses, variola, vaccinia, natural cowpox, stomatitis equi, bird-pox and bird diphtheria may be all simply variants of one and the same virus infection. W. F. HARVEY.

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EDWARDS, S. J. **Studies on Bovine Mastitis. X.—The Value of Field and Laboratory Tests for the Diagnosis of Chronic Streptococcus Mastitis.** *J. Comp. Path. & Therap.* 1934, v. 47, 49-60.

To obtain further experience of the relative values of field and laboratory tests for the diagnosis of chronic streptococcus mastitis, 809 cows in eighteen herds were examined. Of these 295 cows (36·4 per cent) were infected in at least one quarter with mastitis Group 1 streptococcus (*Str. agalactiæ*). The field tests used were the reaction of the milk of individual quarters using brom-cresol-purple paper and the presence of clots, while the laboratory tests were the amount of deposit obtained from the centrifugation of 10 c.c. for five minutes and a cultural examination on a selective blood-agar medium. Many pitfalls occur in the use of the indirect tests and a distinction in their use has to be made between cows in full milk and those in late stages of lactation. With cows in full milk evidence of infection is only reliable when both reaction and deposit tests are positive, while if clots are present in the fore milk this definitely indicates infection. On the other hand in cows in the drying-off stage cultural examination alone is of value. With 219 infected cows examination of the mixed milk samples by deep plating showed the presence of streptococci in 91 per cent. This method was only liable to fail when non-hæmolytic forms were present or when the cow was infected with small numbers of beta-hæmolytic streptococci. [The actual relative utility of laboratory and indirect methods can only be appreciated by a careful study of the comparative figures shown in the tables.] W. G. SAVAGE.

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WILLIAMS, C. L. **Liquid Sulphur Dioxide as a Fumigant for Ships.** *Pub. Health Rep.* Wash. 1934, v. 49, 192-208, 8 figs. (6 on 4 pls.). Also in French in *Bull. Office Internat. d'Hyg. Pub.* 1934, v. 26, 283-92.

HCN has largely replaced SO_2 as a fumigant in U.S.A. ports but it is probable that SO_2 will continue to be used in the smaller ports where highly skilled fumigating crews are not available. The methods of generating SO_2 are: (1) Burning sulphur in pots; (2) burning carbon bisulphide (Salforkose); (3) burning sulphur in a special furnace and blowing the gas into the ship (Clayton); (4) heating liquid SO_2 in a furnace and

blowing the gas into the ship (Marot); (5) introducing liquid SO_2 into the ship and allowing it to vaporize.

The last mentioned has the advantages of giving accurate dosage, eliminating fire hazard and reducing the amount of apparatus. On the other hand it is expensive, though the cheaper grade, described as anhydrous liquid SO_2, containing less than 0·1 per cent of water, is satisfactory. This is obtainable in 150-lb. cylinders, 1-ton drums or in tanks. The handling of the 150-lb. cylinders presents some difficulty, but not sufficient to justify the time and expense of transferring the liquid SO_2 to small 35-lb. cylinders. The cylinder may be used upright, with the valve at the top, when SO_2 gas may be led off; or inverted when liquid SO_2 will be forced out. The former method is too slow to be efficient as the gas pressure rapidly falls. By the latter method liquid SO_2 can be delivered through a sprayer at the rate of 8 to 10 pounds per minute. Delivery is remarkably uniform and therefore dosage can be measured by timing the spraying instead of weighing the cylinder. If the delivery tube and sprayer are quite dry and there is no excess of water in the fumigant there will be no difficulty from freezing.

It is recommended that 4 lb. of liquid SO_2 giving a theoretical concentration of 2 per cent by volume be used per 1,000 cubic feet with an exposure of four hours. Experimentally this gave in a hold 1 per cent SO_2 by volume one hour after liberation of the gas, dropping to 0·6 per cent at the end of five and a half hours, and in a relatively tight pipe casing 0·5 per cent dropping to 0·4 per cent. The calculated concentration of 2 per cent SO_2 is fatal to rats in five to ten minutes but since 0·1 per cent kills in two to four hours, 0·2 per cent in one to two hours, 0·3 per cent in one hour and 0·5 per cent in half an hour, the concentration actually obtained and held even in the pipe casing was ample for rat destruction. Owing to the solubility of SO_2 in water, dampness of holds is an important factor in lowering concentrations.

In the fumigation of loaded ships considerable damage might be done to cargo if large quantities of liquid SO_2 were sprayed down the ventilators. Probably the best procedure would be to discharge cargo from the hatchways till the various hold levels were clear and then fumigate.

CHAS. F. WHITE.

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GILMOUR, J. Expériences sur la fumigation des navires par le gaz Clayton faites par l'administration sanitaire maritime et quarantenaire d'Egypte (2e série). **[Fumigation of Ships by Clayton Gas in Egypt.]** *Bull. Office Internat. d'Hyg. Pub.* 1934, v. 26, 271-82, 2 figs. and 1 folding plan.

Experiments in the fumigation of ships by the Clayton method were conducted in March, 1933, and have already been reported. They showed that: (1) with a concentration of one per cent of Clayton gas for three

hours all rats were killed; (2) with a concentration of 2 per cent two hours' exposure was sufficient to kill all the rats, the majority being dead in an hour·

A second series of five experiments has been undertaken in the S.S. "Ville de Beyrouth," an old pilgrim ship of 3,549 tons. The procedure adopted was to burn sufficient sulphur to give a theoretical concentration of 2 per cent of gas in the ship, and when combustion was complete, to give one hour's exposure. Live rats were placed in the various compartments and concentrations were tested. It was not found possible to obtain a uniform concentration of 2 per cent of gas in all parts of the ship because of slow diffusion, leakage and absorption by moisture. It appears, however, that efficient deratization will be obtained in actual practice if: (1) ships are properly prepared by the opening up of all dead spaces and potential rat harbourages, followed by the careful sealing of all openings through which the gas might escape; and (2) the burning of the sulphur is then commenced, pumping being continued till a concentration of 2 per cent is attained in the upper part of the compartments under fumigation and subsequently at least one hour's exposure is given.

A description is given of a new type of burette for the estimation of gas concentration. This type is correct to about 0·1 per cent, whereas the type formerly used gave results varying by as much as 1·3 per cent.

Chas. F. White.

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Callender, J. H. **Aluminium Foil for Insulation.** *Architectural Forum.* 1934, v. 60, 67-71. [Summary taken from *Dept. Scient. and Indust. Res. Building Sci. Abstr.* 1934, v. 7, 161.]

The principle involved in all uses of aluminium for insulation is the reflection of radiant heat. Still air offers a higher resistance to the transmission of heat by conduction than any available insulating material, but heat is readily transferred through air by radiation and convection. Convection may be minimized by subdividing an air space into small cells, and radiation reduced by bounding the air cells with a material of low thermal emissivity such as aluminium foil. This material may be applied to structural materials or used to subdivide an air space. It is readily obtainable in U.S.A., applied to building paper, plaster and other wallboards and paper-backed wire lathing. When used to subdivide an air space, several sheets of foil may be separated by a skeleton framework of wood, or by sheets of corrugated paper or asbestos, or by partially crumpling the sheets of foil. The foil, on heavy paper, may also be fixed between studs, joists or rafters. Various methods of fixing the material are described and illustrated. Its permanent value as a reflective surface, upon which its insulating properties depend, has been questioned by some. When the metal oxidizes, a transparent film is formed which prevents further oxidation, and it has been stated that the loss of reflectivity under

normal conditions does not amount to more than 2 or 3 per cent. For use under corrosive conditions a thin coat of lacquer serves as a protective and decreases efficiency only very slightly.

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RUDOLFS, W., and ZIEMBA, J. V. **he Efficiency of Chlorine Tin Sewage Disinfection as Affected by Certain Environmental Factors.** *J. Bacteriology.* 1934, v. 27, 419-42, 4 figs.

The Agricultural Experiment Station at New Brunswick, New Jersey, has long been known as the centre of research into sewage disposal problems, and this paper is the result of careful investigation into the efficiency of chlorine in killing the bacteria present in sewage. It has often been assumed that the "chlorine demand" of the sewage must be satisfied before the bacteria are killed, but it is now shown that much smaller amounts are effective in reducing the number of bacteria whether measured by *Bact. coli* or by the total number of bacteria developing on nutrient agar incubated at 20° C. for forty-eight hours. Under the expression "chlorine demand" the authors understand the amount of chlorine which is absorbed by the sewage during a ten-minute contact period. The orthotolidin test was used for estimating the amount of residual chlorine. Tables show the percentage *Bact. coli* reduction with varying amounts of chlorine and with varying periods of contact. For example, with the "chlorine demand" only 10 per cent satisfied, the percentage *Bact. coli* reduction was 22·1 after five minutes and 40·3 after ten minutes; with the "chlorine demand" 70 per cent satisfied, the percentage *Bact. coli* reduction was 89·7 after two and a half minutes and 99·3 after ten minutes.

The results obtained indicate that a percentage reduction of 90 per cent or more in the total count of bacteria is assured with detention periods varying from ten to thirty minutes, when the sewage is chlorinated to the extent of 40 per cent of the chlorine demand.

The effect of lactose, peptone, ammonia and urine added to the sewage has also been studied and it is shown that additions of these substances up to as much as fifty parts per million did not produce any effect on the percentage reduction of bacteria due to chlorination.

The effect of dialysing the sewage, submitting it to storage and to electro-osmosis has also been studied.

The authors draw the following conclusions as a result of their investigations:—

"(1) Bacterial reductions are obtained with partial chlorination of sewage. The reductions vary with the per cent chlorine-demand satisfaction.

"(2) The per cent bacterial reductions produced appear to be affected not only by the per cent chlorine-demand satisfaction, but also by the amount of chlorine required to accomplish the given per cent satisfaction.

"(3) The rate of bacterial kill is greater with lower chlorine-demand satisfactions.

"(4) Contact period variations affect the per cent bacterial reductions when the sewage is chlorinated below the residual.

"(5) Contact periods greater than two and a half minutes do not appear to affect greatly the per cent bacterial reductions when the chlorine demand is satisfied. The velocity in the death-rate increases, for a given per cent chlorine-demand satisfaction, with an increase in the contact time.

"(6) Upon storage, greater per cent bacterial reductions result with low per cent chlorine-demand satisfaction.

"(7) Chloro-peptones and chloro-proteins are neither inhibitory to the growth of bacteria nor germicidal.

"(8) Addition of as much as 50 p.p.m. of peptone, lactose, $(NH_4)_2CO_3$ or NH_4HCO_3 to sewage does not affect to an appreciable extent the per cent bacterial reductions upon chlorinating for ten minutes to the extent of 50 per cent of the chlorine demand. Additions of five cubic centimetres of urine influence to a very marked degree the per cent bacterial removal when chlorinated to the same extent.

"(8) Upon chlorinating sewage, no matter to what extent of the chlorine demand, chloro-products are formed which bring about bacterial reductions.

"(10) The chloro-products formed appear to affect the bacterial reductions to a greater extent with increasing contact times.

"(11) The chlorine demand increases with the increase in the amount of interfering substances." H. T. CALVERT.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 8.

LEVINE, M., EPSTEIN, S. S., and VAUGHN, R. H. **Differential Reactions in the Colon Group of Bacteria.** *Amer. J. Pub. Health.* 1934, v. 24, 505-10. [11 refs.]

A study of the conditions favourable to the Voges-Proskauer reaction showed that a five-day period of incubation was not only unnecessary but actually yielded fewer positive results than a shorter period. Using a special Difco medium they obtained their maximum number of positive results in cultures incubated for forty-eight hours at 37° C. O'Meara's modification of performing the reaction was investigated and his findings were confirmed. To render this method less cumbersome a solution of 0·3 per cent creatine in 40 per cent KOH was made up and added directly to the cultures. This reagent was found to remain stable at room temperature for a fortnight and in the ice chest for four to six weeks. Finally, it was found that a rapid and satisfactory method in practice was to inoculate the medium with a loopful of a young agar slope culture, to incubate at 30° C. for six to seven hours, to add the alkaline creatine solution, and to read the results after a further four hours. Every one of

202 strains of *aerogenes* tested in this way gave a positive reaction. The whole procedure was completed within eleven hours.

A group of strains called Citrobacter, corresponding to the "intermediate" group, was found to be differentiated from the *aerogenes-cloacæ* or Aerobacter group by being MR+, VP−, and H_2S+, and from the *coli* group by growing in citrate, and being indol−, and H_2S+. The ordinary medium for testing H_2S production was found to be unreliable, and the following medium was substituted :—

Proteose peptone (Difco)	20 g.
K_2HPO_4 (anhydrous)	1 g.
Bacto agar	15 g.
Ferric citrate	0·5 g.
Distilled water	1,000 g.

Dissolve by boiling, tube, and sterilize at 15 lb. for fifteen minutes. Inoculation is made preferably from twenty-four-hour broth cultures by stabbing the middle and side of the solidified medium.

The optimum temperature for incubating Eijkman tubes was studied. At an incubator temperature of 45 to 46° C. (temperature of the medium 43 to 44° C.) the *coli* strains uniformly produced gas within forty-eight hours in Eijkman's glucose broth medium and in standard lactose broth. In the latter medium none of the Citrobacter strains produced gas, and only 3·9 per cent of 181 Aerobacter strains did so. When the medium was kept at 45·5 to 46° C., only 64·5 per cent of thirty-one *coli* strains formed gas in Eijkman's medium and 38·7 per cent in lactose broth. It is clear that the best differential temperature is a temperature in the medium of 43 to 44° C.

A boric acid medium was devised that allowed 97·3 per cent of 150 *coli* strains to produce gas within twenty-four hours, while preventing all Citrobacter, and all but 6·1 per cent of Aerobacter strains from doing so. The medium is as follows :—

Proteose peptone (Difco)	10 g.
Lactose	5 g.
K_2HPO_4 (anhydrous)	3 g.
Andrade indicator	10 c.c.
Boric acid	3·0—3·25 g.
Distilled water	1,000 c.c.

Sterilize at 15 lb. for fifteen minutes.

G. S. WILSON.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 8.

PISU, I. Cultures de formes dépourvues de cils de bacilles typhiques et paratyphiques, au moyen de chlorure de lithium ajouté au milieu de culture. **[Cultures of Non-flagellated Typhoid and Paratyphoid Bacilli on Medium containing Lithium Chloride.]** *Boll. Sezione Ital. Soc. Internaz. di. Microbiologia.* Milan, 1934, v. 6, 59-63.

The author records his failure to obtain satisfactory "O" cultures of typhoid and paratyphoid bacilli by the usual procedures, including growth on phenolized agar. Even after repeated subculture he has found that a

proportion of flagellated bacilli remain; and he notes a tendency for the bacilli to undergo a partial rough variation, accompanied by the usual change in the "O" antigens. He states that cultivation on agar containing 0·5 per cent lithium chloride gives far more satisfactory results. After two or three passages on this medium almost all the bacilli have lost their flagella, this loss being associated with a change in colony form from the rather large colony with a thin expanded periphery—a "halo"—to a smaller, more compact, more opaque colony with no surrounding halo. A few further passages result in an abundant growth of typical non-flagellated, smooth bacilli, giving the characteristic "O" agglutination.

W. W. C. Topley.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 8.

Godinho, R., and von Klobusitzky, D. Influence du pH sur l'activité du virus vaccinal. **[Influence of pH on the Activity of Vaccine Virus.]** *C. R. Soc. Biol.* 1934, v. 115, 1352-3.

The activity of vaccine virus is not maintained unless the pH is between four and ten. This is important not only for the preservation of active lymph but in evaluating potency titrations either by dermal or corneal methods. Tests of glycerinated pulp carried out in the Institute Butantan showed the presence of a factor which produced a marked degree of acid to the detriment of the keeping qualities. It was found that the so-called neutral glycerine used was strongly acid owing to the fact that, in its preparation by the hydrolysis of fats with sulphuric acid, a certain amount of acid passes over in the subsequent distillation. The difficulty was successfully overcome by the use of a buffer phosphate solution of pH 7·4 in the proportion of 1 to 1,000 of glycerine, or alternatively by neutralizing with the exact amount of NaOH necessary.

O. K. Wright.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 8.

Reviews.

The Clinical Aspect of Chronic Poisoning by Aluminium and its Alloys. By Leo Spira. London: John Bale, Sons and Danielsson, Ltd. Price 2s. 6d.

In this pamphlet Dr. Leo Spira gives sufficient evidence of the possible dangers of chronic poisoning by aluminium and its alloys to incite the serious interest not only of the medical profession but of the general public.

The bibliography in support of his contentions and against them has already reached considerable dimensions.

There is no doubt that the increasing incidence of such conditions as gastric and duodenal ulcer and diverticulitis cannot be explained merely by more accurate diagnosis or some new hereditary tendency, and the accumu-

lating evidence of the possibility of aluminium, now so extensively used in the manufacture of cooking utensils and in the clarification of water supplies, playing a serious part in the causation of these and other disabilities calls for immediate and thorough research by a reliable body of competent investigators in the interests of the manufacturer and of the health of the general public.

If the Medical Research Council has not already gone into the subject perhaps it would be worthy of their attention.

THE DIGESTIVE TRACT: A RADIOLOGICAL STUDY OF ITS ANATOMY, PHYSIOLOGY AND PATHOLOGY. By A. E. Barclay, O.B.E., M.A., M.D., D.M.R.E., Lecturer in Medical Radiology, University of Cambridge. Published at the University Press, Cambridge. Pp. xxviii + 395. 275 illustrations. Price 36s.

It is an undoubted fact that much experience and knowledge are lost to mankind because those who have them have not been able to face the immense task of the preparation of the manuscript.

Dr. Barclay has laid Medical Radiology under a real debt by this present work. It is a record of his very wide experience not only of the pathological, but of his special study of the normal.

There is much that the non-radiological reader will appreciate, and he will agree with Dr. Barclay's views expressed in the following statement:—

"The radiologist must be a clinician and the wider his knowledge and experience of clinical medicine, the greater will be his advantage as a radiologist. Radiology is all a matter of deduction and there is one and only one safe guide, one key to radiological interpretation—knowledge of the normal. I regard the term 'X-ray' or 'radiological' diagnosis as unsatisfactory. The radiologist gives his opinion on the shadow and his opinion as to the cause of the shadow is based essentially on clinical medicine. He must base his report absolutely and entirely on what he sees and not on what he imagines he ought to have seen. X-ray evidence is but one piece of a jig-saw puzzle which must fit. He may have to exercise self-restraint to avoid calling attention to something that would be better overlooked."

Dr. Barclay stresses the importance of remembering the normal mobility and variety in shape of many structures which one had been taught anatomically to regard as fixed. "It is for the patient and his medical man to find out what Nature designed for that individual. Every engine has an optimum speed at which it is not only most efficient but at which it works most smoothly and lasts longest. The radiologist must report on facts as revealed by his examination: it is for others to determine the line of treatment. It is no part of the radiologist's duty to say whether the clinical picture calls for operative or for medical measures. There is always a very strong tendency to throw unsought and unjustifiable responsibility for the diagnosis upon the radiologist."

This is a book which makes very pleasant reading and is full, not only of the trite sayings of the author, but of much new light on many physiological procedures. It provides a thorough account of the interpretation of the shadows of the various pathological conditions of the digestive tract. There are fifty-six pages which do not come fairly under the title of "The Digestive Tract," viz., "Radiological Risks and their Avoidance," "Organization and Equipment of an X-ray Department," "Radiation Risks of the Roentgenologist," and "Notes on Secondary Rays." The inclusion of these, however, makes the book of additional value to radiologists, as it affords Dr. Barclay an opportunity of putting his long experience of such subjects at their disposal.

The inclusion of the Recommendations of the International X-ray and Radium Protection Committee appears a little unnecessary. This is a habit popular with many writers of X-ray works, but as this book will be on the shelves of most radiologists for some time to come, and frequently in their hands, perhaps new authors will save their publishers a repetition of these four pages.

The illustrations are exceptionally well produced.

BROMPTON HOSPITAL REPORTS. Vol. 11. 1933.

Perhaps the most specialized of all branches of medicine is that which deals with the group of maladies that we are accustomed to style "diseases of the chest." This position has been rapidly attained of recent years since the methods of investigation by lipiodol in conjunction with X-rays have given such brilliant results in diagnosis. The present volume of collected papers and reports by the staff of the Brompton Hospital is so admirable that it is difficult to praise it enough. Here will be found what is wanting in every textbook of medicine however complete—a series of monographs each dealing clearly and completely with one special line of investigation or treatment.

One of the most interesting papers is that in which the value of collapse therapy in tuberculosis of the lung is assessed against that of sanatorium treatment. The time has come to take stock of the position in the methods adopted for treatment of pulmonary tuberculosis in this country and to consider whether the immense sums devoted to the upkeep of sanatoria might not be better employed in rendering more hospital treatment available instead.

About two-thirds of the volume is devoted to papers which deal with tuberculosis of the lung in its every aspect. The remaining articles deal with bronchiectasis, spontaneous pneumothorax, and new growths. We have said this volume is admirable—certainly it contains information of vital importance to all workers on chest diseases. Some day we shall find a medical literature which is for the post-graduate alone—a series of books which will really teach something. Let us hope that such books will be modelled on this excellent example from the Brompton Hospital.

J. H.-S.

Annual Report of the Surgeon-General of the Public Health Services of the United States for the Fiscal Year, 1933. Washington: Government Printing Office. Pp. vi + 128. Price 75 cents (cloth).

This is the Sixty-second Annual Report which has been issued by the United States Public Health Service and covers the period from July 14, 1932, to June 30, 1933, with health statistics for the calendar year 1932.

Surgeon-General H. S. Cummings, in submitting the report, reviews the health conditions throughout the world in 1932, chiefly as regards the outbreaks of influenza and the major communicable diseases. He then proceeds to deal with the health conditions in the United States during the same period in an extremely interesting summary.

In that year the death-rate for the United States was 10·8 per 1,000 of population and was the lowest ever recorded, while infant mortality and the death-rates for tuberculosis, diphtheria and typhoid fever also reached new low records. Some of the figures quoted in this part of the report are striking, e.g. in 1900 the tuberculosis death-rate in the registration area was 201·9 per 100,000 of the population; in 1932 a figure of 61·3 was recorded; diphtheria showed a fall in the same period from 43·8 to 4·8, and typhoid fever one of from 35·9 to 4·6 per 100,000.

During the year there were 4,091 deaths from pellagra, and, although this is considerably less than the numbers in the preceding two years, the Surgeon-General states that many health officers contemplate an increase in this disease on account of economic factors. It is presumed that health education and preventive measures have helped in lowering the death-rate from this disease.

As regards infantile mortality, it is pointed out that in 1915 one infant out of ten born in the United States died in the first year of life; in 1932 this wastage had been reduced to one out of seventeen.

At the same time as the infant death-rate has been falling, the United States, in common with other countries, has experienced a fall in the birth-rate from 25·1 per 1,000 of the population in 1915, to 17·3 per 1,000 in the year under review.

Increased death-rates during the year are noted for cancer, heart disease, and degenerative diseases, all of which have previously shown a tendency to increase.

As in Great Britain, no evidence has yet been found to indicate that distressing economic conditions have had any unfavourable effects on the public health, but an extended investigation into the results of the depression is still going on.

The Division of Foreign Quarantine again shows results of the highest possible standard, and although the total number of vessels arriving was smaller than in the previous year, this division dealt with approximately one and three quarter millions of people arriving by ship and over twenty thousand arriving by air. With such numbers, and in spite of widespread

outbreaks of plague, smallpox, cholera, typhus, yellow fever, and cerebrospinal fever in other parts of the world, the efforts of the staff of the division were able to prevent the introduction of any quarantinable disease into the United States.

The Division of Scientific Research continued the investigations in cancer, heart disease, leprosy and malaria, all of which have been occupying attention for some years past.

On account of the probability that some environmental factor is responsible at least for a predisposition to rheumatic fever and the possibility that some nutritional deficiency might be involved, a series of dogs kept on a diet deficient in vitamin A were inoculated with streptococci isolated from rheumatic fever cases. The results showed that the organisms used tended to produce lesions in the heart and joints, but the results were not uniform and the lesions found did not resemble those occurring in human beings.

A four-year investigation of the application of paris green in mosquito control has shown that dusting at ten-day intervals, if carried out on a county-wide basis, gives satisfactory results.

Further observations have also been made on the value of plasmochin in the control of malaria, and the results of twelve months' work now available show that there was a reasonable reduction in the proportion of infected mosquitoes, but a monthly blood examination of the people in the villages where treatment was being carried out showed practically the same fluctuations in the number of infections as were found in the villages used as controls.

This Division also continues to carry out research in connection with the milk supply at all stages; heat and chlorine as sterilizing agents for milk containers, coolers, etc., were engaging attention, but this work had not been completed at the end of the year. Results have, however, been obtained showing the superiority of a solution of chlorine (100 parts per million) over plain water or soap and water in cleansing the udders of cows before milking is done. The chlorine solution removed ninety-five per cent of a heavy contamination with *B. coli communis* in twenty to thirty seconds compared with a reduction of thirty per cent when soap and water was used.

In the report for the previous year it was shown that 15 per cent of *Aëdes ægypti* set free in aeroplanes in Central America could travel through altitudes of 15,000 to 16,000 feet, and arrive apparently unharmed in the United States. Further observations carried out in 1932 have shown that spraying aeroplanes during flight with an oil extract of pyrethrum resulted in no live mosquitoes reaching the landing grounds.

The Division of Venereal Diseases undertook experimental work in the field of personal prophylaxis in syphilis, and published the results of two preliminary studies, the first dealing with an experimental method of contact infection suitable for prophylaxis work, and the second with the time interval necessary for the penetration of intact mucosa by virulent

syphilis organisms. That most useful publication *Venereal Disease Information* is produced by this Department.

The interesting manner in which such a variety of important matters is dealt with in this book together with its size and price might usefully serve as an example to other governments in their endeavour to interest their people in public health measures with a view to that wholesale co-operation which is so essential if the desired results are to be achieved.

In May, 1933, the Public Health Service administration building in Washington was opened, and the housing of the various administrative sections in one building will greatly facilitate the work of the Service.

THE HYGIENE OF MARRIAGE. By Isabel Emslie Hutton, M.D. London: William Heinemann (Medical Books), Ltd. 1933. Pp. xi + 143. Price 5s.

That a fourth edition of this book has been called for a year after its predecessor shows that there is a great demand for literature on this subject. The author now discusses the whole period of sexual life, and states in her preface to the new edition that her experience in medical practice has shown her the necessity of sex information at all stages of life. The subject is dealt with clearly, without undue elaboration, and in a practical manner.

SECOND SUPPLEMENT TO CATALOGUE OF LEWIS'S MEDICAL AND SCIENTIFIC LIBRARY, 1931-33. London: H. K. Lewis and Co., Ltd. 1934. Pp. 112. Price 2s. (To subscribers 1s.)

Messrs. Lewis have issued a catalogue supplement with a list of the books added to their Library during the period 1933-34. It is divided into two sections, an index of authors and an index of subjects.

There are close on 3,000 authors whose works have been added to the Library, and some of them have had more than one publication added.

The index of subjects includes, in addition to all branches of medical science, works on astronomy, archæology, biography, bee-keeping, chemistry, physics, and other scientific subjects.

Notices.

ACETYLCHOLINE BROMIDE.

A STERILE stable solution of this substance has been issued by Burroughs Wellcome & Co., Snow Hill Buildings, London, E.C.1, as a "Hypoloid" product. It is issued in "Hypoloid" ampoules each containing 0·1 grm. in 1 c.c. in boxes of 10.

Acetylcholine is the acetyl ester of choline. It has been isolated in chemically recognizable quantities from the spleen and from the placenta,

and is present in minute traces in other organs. It is very highly active; a dilution of one in a million millions in the blood of the cat will produce a transitory fall of blood-pressure. Its action is very evanescent as it is rapidly hydrolysed to acetic acid and choline by an esterase present in blood and tissues.

Acetylcholine is usually administered by intramuscular injection, and is stated to be particularly successful in counteracting paralysis of the intestine such as occurs after laparotomy and intestinal operations. It may be used to relieve severe post-operative gas distension and pain, and to a certain extent, to relieve acute constipation. It is also of value in certain types of vascular disturbances associated with arteriolar spasm.

ROYAL ARMY MEDICAL COLLEGE LIBRARY.

LIST OF BOOKS RECEIVED DURING THE PERIOD APRIL 1 TO AUGUST 31, 1934.

Author(s)	Title of Work	Grant or Not
Glyn Jones	The Pharmacy and Poison Acts Explained ..	Grant
Paterson & Smith ..	Modern Methods of Feeding in Infancy and Childhood	,,
Hopkins	Water Purification Control	,,
Imms	Textbook of Entomology	,,
Walker	Enlarged Prostate and Prostatic Obstruction	,,
Glasser	The Science of Radiology	,,
Barclay	The Digestive Tract—Radiological Study ..	,,
Cole	Practical Physiological Chemistry	,,
Fearon	Introduction to Biochemistry	,,
Wright	Applied Physiology	,,
Rogers	Physics for Medical Students	,,
Bentley & Driver ..	Textbook of Pharmaceutical Chemistry ..	,,
Gershenfeld	Bacteriology and Sanitary Science	,,
Mayou's	Diseases of the Eye	,,
Plimmer	Organic and Biochemistry	,,
Rea	The Diet Book	,,
Levine	Laboratory Technique of Bacteriology ..	,,
Vernon	The Principles of Heating and Ventilation ..	,,
Duckworth & Harris ..	The Laboratory Workshop	,,
Paul	Cutaneous Neoplasms	,,
Baker Institute of Med. Research	Practical Anæsthesia	,,
Glazebrook	Dictionary of Applied Physics. 5 vols. ..	,,
Jameson & Parkinson ..	Hygiene. 3 copies	,,
Panton & Marrack ..	Clinical Pathology	,,
Parsons	Diseases of the Eyes	,,
Beaumont & Dodds ..	Recent Advances in Medicine. 2 copies ..	,,
Fleming & Petrie ..	Recent Advances in Vaccine and Serum Therapy	,,
Davies	Practical X-Ray Therapy	,,
Leschke	Clinical Toxicology	,,
Hadfield & Garrod ..	Recent Advances in Pathology..	,,
Brailsford..	Radiology of Bones and Joints..	,,
Legge	Industrial Maladies	,,
Park & Williams ..	Pathogenic Micro-organisms	,,
Waters & Kaplan ..	The 1933 Year Book of Radiology	,,

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, Journal of the Royal Army Medical Corps, War Office, Whitehall, London, S.W. 1."

MANAGER'S NOTICES.

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Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed 'Holt & Co.'

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

Communications in regard to subscriptions, change of address, etc., should be addressed "The Manager, Journal of the Royal Army Medical Corps, A.M.D.2, War Office, Whitehall, London, S.W. 1."

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Communications regarding Advertisements should be addressed—

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VOL. LXIII. NOVEMBER, 1934. No. 5.

Journal
of the
Royal Army Medical Corps.

Original Communications.

AVERTIN IN ANÆSTHESIA.

BY MAJOR L. S. C. ROCHE, M.C.,
Royal Army Medical Corps.

PREMEDICATION with basal narcotics to render the induction of the usual anæsthetic agents more pleasant and safer has in recent years been receiving considerable attention on the part of anæsthetists, and satisfactory reports as to the value and safety of such methods are now and then appearing in the medical press.

Having completed a series of over 200 consecutive routine administrations of avertin, I venture to submit to readers of our Journal details of the methods used and the conclusions reached as to their value.

Chloroform and ether, or combinations of both, are still commonly used as anæsthetic agents. Even in skilled hands chloroform may produce toxic effects on the heart, liver, and kidneys, while ether is an irritant which may affect the lungs. As a result complications and even fatalities have occurred.

It was for the above reasons that Captain J. Sheppherd, I.M.S., who was once my surgical colleague, not only suggested the trial of basal narcotics, but went to great trouble in obtaining the first supply of avertin, which at the time was not available in India.

Our first impressions were so favourable, that I have used avertin in premedication almost entirely as a routine measure ever since.

The makers of the drug, Messrs. Bayer—Meister, Lucius, have published an excellent brochure bearing on its chemistry and pharmacology, together with the necessary guiding lines for its administration, to which readers

are referred. I propose, however, to make a few observations on the following points: Contra-indications, preparation and dosage, administration, pre-operative effects, further steps for completing anæsthesia, post-operative effects, application to midwifery, disadvantages, comparison with some other basal narcotics, nature and number of operations carried out, conclusions and dosage table.

CONTRA-INDICATIONS.

The contra-indications to the use of avertin are: Grave renal disease owing to possible interference with elimination; grave hepatic disease owing to possible interference with detoxication processes; advanced pulmonary tuberculosis or the presence of severe lower bowel disease.

Inquiry and examination regarding the above-mentioned points together with routine examination of the urine should therefore always be made.

PREPARATION AND DOSAGE.

Avertin or tribromethyl alcohol is a white crystalline powder supplied by the makers in this form, or as "liquid avertin," i.e. dissolved in amylene hydrate. The latter is not only more convenient, as it can be quickly measured and rapidly dissolved, but it appears to be more readily absorbed.

The range of dosage is from 0·05 to 0·18 cubic centimetre per kilogramme body-weight. Experience shows that doses below 0·1 cubic centimetre per kilogramme body-weight are too uncertain in action for ordinary purposes. On the other hand, doses of 0·18 cubic centimetre are generally excessive and tend to give rise to restlessness after operation. Therefore 0·1 cubic centimetre per kilogramme body-weight is considered the normal optimum dose but with the following reservations: Children and nervous adults, and also certain cases where it is proposed to use avertin alone, require more, i.e. 0·15 cubic centimetre per kilogramme body-weight.

The solution must be prepared immediately before administration, its exposure to air for any length of time favouring the formation of hydrobromic acid which is a dangerous rectal irritant. It should be meticulously prepared as follows:—

The calculated amount of liquid avertin is poured into sufficient warm distilled water to make up a 3 per cent solution, the temperature of which must be kept at blood heat. Higher temperatures may lead to hydrobromic acid formation; solutions at lower temperatures are not so well absorbed, probably because the drug is not properly dissolved.

The mixture is then vigorously shaken in a large bottle for two minutes. Just prior to administration the Congo-red test must invariably be applied to make sure that the solution is free from hydrobromic acid. With each bottle of avertin the makers supply a small bottle of 1:1000 Congo-red aqueous solution, a few drops of which are added to five cubic centimetres of the avertin mixture. The resultant colour should be orange-pink, but if the slightest trace of blueness or blue deposit is present the mixture contains hydrobromic acid and is unsuitable for use.

"Liquid avertin" seems to keep well even in the tropics. Only once on using the contents of a new bottle did the blue tint appear; in this case the makers' agents replaced the defective bottle.

Administration.

The evening prior to the morning of operation a soap and water enema is given to the patient. It is better not to repeat it on the morning of operation as the avertin is more easily absorbed and more readily retained when the bowel is at rest.

In the case of rectal operations the enema should be given on the morning of the operation. For the reason already given and because it is almost impossible to keep the site dry during operation, avertin is not very satisfactory for such cases. A few minutes before the administration of avertin, if it is intended to complete anæsthesia with ether, atropin, gr. $\frac{1}{100}$, is given subcutaneously; but for short operations on the mouth and throat such an injection can be omitted as avertin itself inhibits salivation. Morphia, prior to avertin, does not appear to be indicated as a routine, though I have sometimes administered $\frac{1}{6}$ to $\frac{1}{4}$ grain when an extensive operation was contemplated.

The room should, if possible, be darkened or screens placed round the bed and the patient's ears plugged with wool. Quiet and silence must be maintained throughout.

Half an hour before operation the patient is instructed to lie on the left side and the solution of avertin, as above prepared, is slowly injected high into the rectum through a funnel and well-lubricated catheter. Seven to ten minutes should be taken over the injection, during which time the patient is exhorted to go to sleep and discouraged from talking. As a rule the patient is asleep in ten to fifteen minutes, but should not be moved to the operating theatre under thirty minutes from the commencement of the injection.

Administered as described, the comparatively small amount of fluid injected is not an unpleasant ordeal for even a nervous patient, and the effects produced while the patient is falling off to sleep are invariably described as extremely pleasant.

Pre-operative Effects.

The sleep produced by avertin in normal dosage is a deep one from which it is difficult to rouse the patient, but it differs from complete anæsthesia in that pinching or pricking the skin will elicit a slow movement of the limbs. The cough reflex is usually not abolished entirely and the patient can swallow.

The pupils are contracted and the face is flushed. If there be any cyanosis and stertor these are merely due to relaxation of the jaw muscles; hence an attendant should always be present to keep the head to one side and the jaw forward.

Respirations become slower and shallower and there is a fall of blood-pressure (systolic drop of ten to twenty-five millimetres of mercury). Such a fall never gave rise to anxiety nor called for special treatment, as it passed off after a short time, particularly after a few inhalations of ether. Actual experiment showed that this fall in blood-pressure was of lesser extent and not so lasting as that which occurs during intrathecal anæsthesia.

It is at this stage, viz., thirty minutes after the commencement of the rectal injection, that the patient is moved to the operating theatre.

The first advantage of this form of premedication is now apparent. We have a patient who has been peacefully put to sleep in bed and who is spared not only the unpleasant, in many cases the terrifying, consciousness of the operating theatre but also that of the face-piece and of the smell of anæsthetics.

As a further development of the method, on two occasions, in the case of nervous children, I have had the avertin administered in their homes prior to removal of tonsils and adenoids at the hospital and sent them home again after the operation before the effects of the avertin had passed off. Thus, apart from a complaint of sore throat, these children never realized they had left their beds, still less that they had undergone an operation.

Further Steps to Complete Anæsthesia.

For nearly all dental operations and for short operations on the fauces and the nasopharynx no additional anæsthetic is required. In such cases jaw relaxation is nearly always sufficient and both cough and swallowing reflexes are present, which is an ideal not so easily obtainable in other forms of anæsthesia. The operator moreover has the field to himself. All the above points present very real advantages to patient, surgeon and anæsthetist.

For the few cases not under the complete influence of avertin, for all abdominal operations, i.e. requiring complete abdominal relaxation, or for any lengthy operations, some additional agent must be used to obtain complete anæsthesia.

In a few cases of this series local infiltrations of novocain were successfully used, even for abdominal operations, but for the majority of cases ether on a Schimmelbusch mask was used.

Shortly after a small quantity of ether has been administered, the breathing becomes deeper and the initial dusky flush gradually gives way to a healthy pink coloration. It will be found that the ether can be used much more sparingly than would be the case without a basal narcotic (less than 50 per cent is required). There is no struggling stage and in five to ten minutes the patient is ready for operation.

As the pupils remain contracted throughout, the guiding signs are the respirations, which should be slow, quiet and fairly deep, the colour, which should be pink without any trace of cyanosis, and the complete relaxation and absence of movement.

Ether may have to be pushed somewhat at the time of the skin and peritoneal incisions and when there is much peritoneal traction during the operation, but as a rule it is possible to stop the administration some time before the end of the operation.

It was noted how well certain difficult subjects, such as the short, stout man, took this form of combined anæsthesia without a change in colour or a sign of stertor or laryngeal spasm. In fact the striking point in all cases was the unusual "smoothness" of the administration, it being almost impossible for the patient to develop any dangerous or even unpleasant concomitants.

To recapitulate further advantages: A smooth and complete anæsthesia without struggle and without tendency to sudden changes into dangerous states; for the anæsthetist, an easy administration without constant worry and alertness; and for the surgeon a subject well relaxed and of good colour on whom he can carry out any operative procedure without interruption or worry.

To these advantages must be added the fact that the use of chloroform is entirely avoided and that only comparatively small amounts of ether are used, thus reducing the possibility of ether respiratory complications.

The Post-operative Period.

From one and a half to two hours after commencement of the avertin administration the effects begin to wear off, and the avertinized patient passes into a condition of "twilight sleep" from which he now and then partially awakes and from which he can be aroused. Forty per cent of subjects tend to be restless, a few even requiring morphia: this is one of the greatest disadvantages of avertin. On the other hand, post-operative vomiting is rare (about 10 per cent, particularly in cases where considerable traction on and handling of peritoneum has taken place) and then usually only once or twice, so that the necessity for careful post-operative nursing is not sensibly increased compared to other methods of anæsthesia.

Six to eight hours after administration the patient regains full consciousness, remembers nothing of any event since administration and complains of no unpleasant sequelæ.

The advantages derived at this stage are freedom from pain for several hours following operation, absence of toxic vomiting and other unpleasant or dangerous states, and in many cases a quiet sleep.

Avertin in Midwifery.

It was used in a case of Cæsarean section in combination with ether, with satisfactory results.

It was also used in four normal parturition cases among primiparæ. The results in these cases are definitely unsatisfactory, and not to be compared to narcosis with pernocton or with morphia-scopolamine for the following reasons: The rectal injection is invariably rejected when uterine contractions occur, thus leading the administrator into doubt as to dosage.

Avertin appears to reduce the frequency and extent of uterine contractions. If administered during the second stage, it seems to produce excitement and restlessness. Avertin is therefore not recommended in midwifery.

Disadvantages.

The extra cost involved; this works out in India at approximately Rs. 2/8/- to Rs. 3/- per administration. On the other hand, the considerably reduced consumption of the volatile anæsthetic used in conjunction must be set against the increased expenditure.

The time and special arrangements necessary in preparing and administering avertin; working under schedule with an experienced team, there is little, if any, time wasted. Moreover, the advantages to the patient are worth the extra trouble taken.

The difficulty in determining exact dosage; this disappears largely with increasing experience. The exceptional case where the sleep produced is too light still responds to respiratory anæsthetics better than usual.

The restlessness during the recovery period; this can be largely minimized by the administration of morphia. No serious after-effects could be traced to this factor.

Comparison with other Basal Narcotics.

Other basal narcotics with which I can compare avertin are paraldehyde and pernocton.

The paraldehyde induction period is at least twice as long as that of avertin, is more uncertain in its action, and is sometimes very irritating to the rectal mucous membrane. Avertin is therefore considered superior to paraldehyde.

With pernocton given intravenously the induction period is very rapid, almost instantaneous. In this respect it is superior to avertin. But whereas avertin is applicable to all ages and weights, the intravenous administration of pernocton at once curtails its application in the case of children and stout subjects. The sleep produced by pernocton is neither so deep nor so prolonged, and is often accompanied by marked excitement, restlessness and clonic movements. Avertin is therefore considered superior to pernocton.

Nature and Number of Operations Carried Out.

Abdominal operations	52
Gynæcological operations	15
Operations on head and neck	4
Operations on bones and joints and manipulations	17
Operations on hernia, varicocele, hydrocele	21
Operations on fauces and nasopharynx	34
Operations on rectum, anus and perineum	11
Operations on hands and feet	11
Operations on blood-vessels	2
Circumcisions	4
Amputation, foot	1
Amputation, breast	2
Multiple dental extractions	39
Midwifery	5
Total	218

In this series there was one post-operative death, not attributable to the action of avertin. The details are as follows :—

A very debilitated and cachectic woman, aged 65, suffering from a large fungating carcinoma of the breast, was recommended for amputation of the breast with a view to alleviating the constant and severe pain, as morphia in big doses was ineffective. Owing to the condition of the patient the use of a respiratory anæsthetic was considered too risky, but as the septic condition of her teeth called for treatment extractions were carried out under avertin alone, and she recovered quite normally. Two weeks later the breast amputation was performed under avertin and local infiltration of novocain. Three hours after operation she had nearly recovered full consciousness, but she died soon after, exhibiting symptoms of shock.

Conclusions.

(1) Avertin alone is unsuitable for most operations except for multiple dental extractions and operations on the fauces and nasopharynx.

(2) Avertin carefully administered in reasonable dosage, in combination with ether, gives an anæsthesia which is pleasant to the patient and specially indicated in nervous subjects, and is suitable for most operations.

(3) This form of combined anæsthesia is generally a safer one, as it does away with the necessity of chloroform, is "smooth" and easy, and appears to be free from toxic after-effects.

(4) The patient's speed of post-operative recovery and convalescence is unmistakably enhanced, even after severe operations.

(5) For the reasons enumerated above, there is no doubt whatever that the advantages gained far outweigh any disadvantage which may be advanced against the more common use of avertin.

Avertin Dosage Table.

Normal dose : 0·1 cubic centimetre per kilogramme body-weight.

1 lb. = 0·45359 kilogramme.

1 stone = 6·3503 kilogrammes.

Stones	Kilogrammes	Dose. Cubic centimetres	Dose. Minims	Water (distilled) to make 3 per cent solution. Ounces
6	38·10	3·81	64	4½
7	44·45	4·44	75	5½
8	50·80	5·08	86	6½
9	57·15	7·71	97	7¼
10	63·50	6·35	107	8
11	69·85	6·98	118	8¾
12	76·20	7·62	129	9½
13	82·55	8·25	140	10¼

Note.—When the anæsthetist orders 0·15 cubic centimetre per kilogramme body-weight add half the calculated amount of liquid avertin and water to the original amount.

In conclusion, the thanks of the writer are due to Colonel G. G. Tabuteau, D.S.O., lately Commanding the British Military Hospital, Karachi, for permission to forward this report for publication.

PERIOTIC DEAFNESS.

By Major C. A. HUTCHINSON,
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A few months ago a colleague, whose opinion in most things medical I value very highly, asked me to see a case of "otosclerosis," and added that he had had several cases of this complaint. In due course the patient arrived and turned out to be a man on the wrong side of 60.

Further inquiry since has elicited the fact that many medical men make a similar error in diagnosis, and it is in the hope of helping to elucidate this point that I am venturing on this article.

Now periotic deafness is of two types:—

(1) Due to conditions starting in the mucous membrane of the middle ear—"Membranous periotic deafness."

(2) Due to conditions starting in the bone of the periotic capsule—"Otosclerosis."

(1) Membranous Periotic Deafness.

This condition is usually transitory and recovers spontaneously. Its earliest stages are seen in acute and subacute otitis media, the result of a common cold.

There is no particular age-incidence, nor does it tend to predominate in one sex more than in the other, except in so far as that adult males having in the past, at all events, followed more outdoor occupations and having therefore been more subject to colds, there has been a predominance among males.

Pathology.

There is a subacute inflammation of the mucosa of the middle ear, especially in the region of the oval and round windows; once a fibrotic state has been initiated, no treatment will remove the excess of fibrous tissue already formed, or prevent it from subsequently contracting.

In certain cases it is the result of *acute otitis media* and persists until myringotomy has been performed and for a while afterwards, the duration of such persistence depending on: (*a*) Duration of the otitis media before myringotomy was performed; (*b*) the activity and nature of the inflammatory process.

In very few cases is the hearing damaged after acute otitis media, but when it is the deafness is so severe in degree as to interfere materially with the earning of a livelihood.

Now, whereas in acute otitis media the eustachian tube is blocked, in *subacute otitis media* it is intermittently patent; moreover in the latter condition the inflammatory process is of low grade as the micro-organisms are of low virulence and the pus can drain away down the patent eustachian tube; if such drainage is efficient, then recovery occurs, but should it be

inefficient the state of inflammation may be long maintained and there is a very gradual advance in the degree of deafness.

Subjective Symptoms.

Deafness.—There are three different ways in which the hearing may be affected in membranous periotic deafness :—

(1) The mucosa round the oval window is affected, but that in the region of the round window escapes. There is considerable loss of hearing for the lower tones; the hearing for higher tones is comparatively unaffected; Rinné is negative (i.e. B.C. is greater than A.C.) for the lower tones.

(2) The mucosa in the region of the round window is affected, but that round the oval window escapes. The lower tones are heard moderately well; the hearing for the highest tones is lost.

(3) The mucosa in the region of both windows is affected. There is good, or at least fair, hearing for the middle tones; there is also progressive loss of auditory acuity for the tones towards either end of the register.

Paracusis.—In about half the cases there is well marked paracusis, but in 99 per cent of these it is "false paracusis."

There are three conditions of altered hearing which closely simulate periotic deafness and which have to be excluded in making a diagnosis. In all three the degree of deafness is high, but the hearing is quite suddenly restored almost, or quite, to normal.

(*a*) In the case of *auditory fatigue,* to which ears with this kind of deafness are very prone, temporary recovery occurs.

(*b*) Where the condition is apparently due to an *altered cochlear blood supply* the inhalation of amyl nitrite, or listening to a loud buzzing noise (which congests the tympanic blood-vessels) will temporary restore the hearing.

(*c*) Where there is an *overstretched tensor tympani*: here the clinical symptom is deafness for conversation, coming on in waves, while there is good hearing for simple tones (so-called "curtain deafness"). Temporary recovery of hearing can be secured by the use of artificial wax.

Prognosis.

If periotic deafness is present and the patient has never had a perforation the eustachian contents should be aspirated and subjected to microscopical examination.

If the contents contain no micro-organisms, or such micro-organisms as there are disappear in one and a half hours on standing, the case is recovering spontaneously.

If desquamated cells are present, leucocytes are sparse, and the mucus is thin, the deafness is apt to be more severe than in the above type of case.

Treatment.

The treatment of both types of periotic deafness will be considered together.

(2) Bony Type of Otosclerosis.

This is a condition affecting 0·5 per cent of patients.

It does *not* necessarily produce deafness; only doing so when either (*a*) the channels of the cochlea, (*b*) the auditory nerve fibres, or (*c*) the membranes of the round and oval windows are encroached upon. It is then characterized by chronic progressive deafness; there are no ordinary symptoms of catarrh.

Pathology.

There are three distinct stages in its development:—

Stage 1. *Periosteal congestion* of the inner tympanic wall, causing trophic changes in the bone.

Stage 2. *Osteoporosis*: (*a*) Most commonly of the promontory in the region of the anterior margin of the oval window, where there is an anastomosis between the vessels of the middle ear and those of the labyrinth capsule; (*b*) of the bone of the vestibule; (*c*) of the cochlear walls; (*d*) of the bony semicircular canals. Along with the osteoporosis there is osteosclerosis and degeneration of the organ of Corti.

Stage 3. *Bony overgrowth*, resulting in ankylosis of the stapes.

Many theories have been advanced as to the ætiology of this interesting condition, of which the principal are:—

(1) That it is due to a chronic, locally infective, inflammatory process starting in the mucoperiosteum of the middle ear.

(2) That it is due to a hereditary developmental anomaly in the post-embryonic growth of the labyrinth capsule, the primary fault being an inherent defect in the living cells of the organ of hearing.

(3) That it is part of a general toxic condition; the bony changes being similar to those found in osteitis deformans, rickets and osteomalacia.

(4) That it is due to trophic changes in the eighth nerve, associated with parathyroid hypofunction. (There is diminished blood calcium in otosclerosis.)

(5) That it follows diminished local arterial supply.

(6) That it is associated with anæmia.

(7) That it follows otitis media.

(8) That it is of the nature of a neoplasm.

(9) That it is a familial or congenital condition (Hammerschlag's type, and Van der Hoewe's syndrome).

(10) That it is in some way associated with the sex functions, and alterations in these; for it occurs most frequently at puberty, during pregnancy and the menopause (some authorities, however, dispute this, and state that it occurs most frequently between the ages of 20 and 30); while a series of exacerbations are associated with any causes making a severe call on the vital forces.

(11) That it is a gouty manifestation, it being often associated with this condition.

(12) That it is associated with other mesenchymous tissue abnormalities (e.g. fragilitas ossium, blue sclerotics, etc.).

None of the above theories, however, seems to cover all the facts and the most attractive explanation to date is that of Eckert Moebius, which is that there are the following factors: (*a*) *A constitutional factor*—inherent endocrine disturbances affecting the mesenchyme; (*b*) *biologically feeble osseous tissue*—in the region of the anastomosis between the vessels of the middle ear and those of the labyrinth capsule; (*c*) *metabolic disturbances*—acting as exciting factors.

Proven facts regarding it are: (*a*) That it has a definite racial predilection for Jews; (*b*) that it is especially prevalent in females; (*c*) that in certain cases it certainly *is* congenital and familial; (*d*) that fragilitas ossium is prevalent in families showing the familial tendency to otosclerosis; (*e*) that a high proportion of cases are congenital in nature, but delayed in onset.

Subjective Symptoms.

Tinnitus.—With a family history of early progressive deafness, which does not respond to treatment, tinnitus is at first intermittent; it may become continuous and very intense. The rapidity of progress of the condition varies with the intensity of the tinnitus.

Whereas in dry catarrh the tinnitus is usually referred to the ear affected, in otosclerosis the tinnitus is as a rule referred to the head.

Progressive Deafness.—Very little affected by climatic changes; it is worse after fatigue. At first it is unilateral, and often the first sign is inability to hear low general conversation.

Vertigo.—This is rarely found.

Paracusis.—Often marked, but "false" in character.

Objective Signs.

(1) Inspection of the tympanic membrane shows nothing; or it may be found that the membrane transmits the pinkish colour of the promontory. This, when found, is pathognomonic.

(2) The external auditory meatus is glazed and dry.

(3) The eustachian tube is often widely patent.

Note.—It must be borne in mind that evidence of eustachian obstruction or the presence of chronic suppurative otitis media does not negative a diagnosis of otosclerosis.

Types of altered Hearing found in Bony Otosclerosis.

These conform to those found in membranous periotic deafness (*q.v.*). It is therefore unnecessary to repeat them in detail, and it will suffice to point out:—

Type I, some 1 per cent of cases.—This is due to altered movements of the stapes. It produces deafness very similar in type to obstructive deafness, but eventually of far greater degree.

Type II, some 2 per cent of cases.—This is found when the region of the round window is involved. It is characterized in some cases by a sudden

drop in hearing for the highest tones (this constitutes the "Manasse type"). Here it is the first turn of the cochlea which is affected, and the altered bone presses on the nerve filaments between Corti's organ and the spiral ganglion.

Type III, some 97 per cent of cases.—This is characterized by: Negative Rinné for the lower tones; positive Rinné for tones about the middle of the register; neutral Rinné for two tones—one in the neighbourhood of 64, and the other between 256 and 1,024. Lastly, the pitch at which the lower Rinné is obtained rises as the deafness increases.

Deafness in bony type of otosclerosis tends to be of "uncompensated type." Now many cases of "uncompensated deafness" do not hear because the patient does not listen, but in clinically recognizable otosclerosis there is a definite reason for the lack of compensation, which is that the ends of words are not cut off sharply by the ear in hearing, i.e. "Abklingen Deafness", and speech is only audible to these patients when its rate is very slow, i.e., some one or two syllables per second.

The diagnosis of osseous otosclerosis cannot be made with certainty during life, but is mainly a matter of conjecture based on the presence of profound middle ear deafness, not responding to any form of treatment, without there being any signs of middle ear disease.

Prognosis.

This is definitely bad.

The patient should be told that the condition is not serious so far as danger to life is concerned; that the progress of the condition is very slow, and that she (for the patient is usually a female) has not got "brain disease"—for with some patients fear of this amounts almost to an obsession.

Treatment.

Beware of confusing the membranous and osseous types in the early stages. The membranous type is eminently curable when taken early, and it is therefore best to regard all cases as being membranous in type and to treat them as such, until the utter hopelessness of the case shows it to belong to the bony type.

It must be clearly realized that local treatment is useless, or may be actually harmful. It may, however, be worth while trying eustachian aspiration at weekly or more frequent intervals, and when pus is no longer present spraying the eustachian tube with liquid paraffin on one or two occasions.

The general health should be maintained, and anæmia should be energetically treated with iron and arsenic. This is most important.

The iodides and phosphorus have their advocates.

Any local septic focus in the nose, nasopharynx, etc., should be thoroughly attended to.

Some cases show a definite mild acidosis, and for such the judicious use of sodium bicarbonate is recommended.

Autogenous vaccines from the nasopharynx have been suggested, but their use is of very doubtful value.

Galvanism may be tried, but it acts (if at all) mainly by suggestion.

Endocrine therapy may be given a trial as follows: Pituitary extract one half grain daily by the mouth for a month. Then wait a month and repeat.

Adrenal extract has also been tried.

A line of treatment which has found favour with some authorities is to give :—

Zinc phosphide	$\frac{1}{10}$ grain
Lecithin	4 grains
Calcium glycerophosphate	4 ,,

One cachet of the above thrice daily for three months. Then interrupt this treatment for one month ; during the interval give four injections of Martindale's ampoules of pituitary—one cubic centimetre at a time. This full course to be repeated three times.

As regards the hearing, try and establish "compensation," and re-train the patient to hear.

The tinnitus and vertigo should be treated by first freeing the eustachian tube from infection and removing the primary infective focus ; then inflate via the eustachian tube with the external auditory meatus filled with artificial wax. This must not be left in for more than seven days.

A good formula for artificial wax is :—

℞	Spermaceti	1 dram
	Cera flava	1 ,,
	Lanolin	1 fluid ounce

the right consistency being arrived at by varying the proportions of the ingredients.

If all the above methods have failed the patient should be taught to lip-read, and, if there be paracusis, given an electrical aid to hearing—once the hearing has become stabilized. If there be no paracusis, give the shell type of instrument.

Lastly, there remains Sourdille's operative method. This has been performed by him in over 150 cases with some fair prospect of success, but the risk of entirely destroying the hearing has to be taken. The operation consists in the construction of a new secondary tympanic membrane in the region of the external semicircular canal from a flap of tympanic membrane, and is carried out in three stages as follows :—

Stages 1 *and* 2.—These are performed under general anæsthesia, and consist of: (*a*) Construction of a flap of membrana tympani, after performance of a modified radical mastoid operation. (*b*) Sliding along of the flap as a graft to a position over the external semicircular canal. The cavity is allowed to epithelialize completely after each stage.

Stage 3.—Under local anæsthesia the graft is raised and the external semicircular canal gradually chiselled through, till suddenly the patient remarks that he can hear. The graft is then replaced and the wound allowed to heal.

Summary.

(1) There are two distinct types of periotic deafness: That due to changes in the mucous membrane and that due to changes in the bone.

(2) The prognosis of the two is very different, the membranous type being eminently curable in the early stages, while the bony type is definitely hopeless.

(3) It is best to regard all cases as membranous and to treat them energetically as such, until failure of response to treatment after prolonged trial shows that it is useless to persevere further, as the osseous type must be the one prevailing.

(4) When attention to any local focus of sepsis has been paid and the various medical lines of treatment suggested have been all tried out to no purpose, the patient should be taught to lip-read and fitted with the appropriate aid to hearing. Finally, it may be worth while giving Sourdille's operation a trial.

DYSENTERY AMONG TROOPS IN QUETTA.

PART II E.—NOTES ON THE AMŒBÆ FOUND.

By Lieutenant-Colonel D. T. M. LARGE,
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(*Continued from p.* 237.)

During the year 1932 large numbers of amœbæ were found in Quetta. Cases showing these amœbæ increased in number during the dysentery season and fell off as the cold weather came on, when there was practically no dysentery. Many of these amœbæ were diagnosed *Entamœba histolytica* in spite of the absence of contained red blood-corpuscles on the grounds of active and progressive motility, together with clear pseudopodia in an amœba measuring from 20 to 40 microns.

Wenyon in his textbook "Protozoology" (1926) states: "The tissue invading form of *E. histolytica* as a rule varies in diameter from 20 to 30 microns, but larger or smaller forms may occur. A very characteristic feature of the amœba is its activity, large blunt pseudopodia being formed and withdrawn in rapid succession. . . . Though occasionally *E. coli* will be seen to move with an activity almost if not quite equal to that of *E. histolytica,* this is rarely the case, and the energetic movements of *E. histolytica* serve as one of its most important distinguishing features. . . . The number of amœbæ in any particular specimen containing red blood-corpuscles varies considerably. Sometimes as many as 25 per cent will show them, while in other cases a long search will reveal only a single one or none at all. . . . As regards the large amœbæ from 15 to 20 microns or more, if they occur in dysenteric stools, and are very active, they are probably *E. histolytica.*"

It was on grounds such as these, and on others less important, that the diagnosis of amœbic dysentery was made in 1932 in this laboratory. Much time was spent on searching every case, with the result that on compiling the figures for the year it was found that amœbic dysentery formed a considerably larger proportion of the Quetta dysentery than is normally the case elsewhere in India. Such finding naturally was regarded somewhat with suspicion by colleagues to whom it was submitted for criticism, chiefly in connection with the fact that *E. histolytica* had been reported in many of the cases in the absence of contained red blood-corpuscles.

In order to provide a better foundation for the diagnosis of amœbic dysentery in 1933, records were kept of every case in which an amœba was

found, the amœbæ being described in detail in each case. A total of 166 cases showing amœbæ was found amongst 1,042 cases of dysentery and diarrhœa, and tabulated as follows :—

(1) Bacillary dysentery cases	448, showed amœbæ in	64
(2) Clinical dysentery cases with indefinite exudate microscopically	242, ,, ,, ,,	73
(3) Diarrhœa cases showing neither blood nor pus cells microscopically	352, ,, ,, ,,	29
	1,042	166

The amœbæ have been divided, for descriptive purposes only, into four classes depending on their contents and the nature of their movements. Size was not considered, as the number below 20 microns was negligible.

Class I (total 47). This includes all amœbæ in which definite red blood-corpuscles were observed rolling about amongst the contents. These were diagnosed *E. histolytica* and formed 28·3 per cent of the total number of amœbæ found.

Class II (total 21). All the amœbæ placed in Class II were actively progressive and all had clear pseudopodia. Some cases showed the presence of cysts of *E. histolytica* during convalescence, but the majority were put into this class because the contents of the amœbæ resembled red blood-corpuscles. This point will be elaborated shortly. Amœbæ of this class formed 12·6 per cent of the total numbers found.

Class III (total 28). Certain amœbæ were distinguished only by the nature of their movements, which were definitely progressive and active; 16 8 per cent of the total amœbæ were of this nature.

Class IV (total 70). The remainder of the amœbæ found, 42·1 per cent of the total, had none of the distinguishing features of *E. histolytica*, and therefore were classed separately.

This classification, unscientific as it is, is based on features which are readily observable when examining fresh specimens under the microscope. It is essential, however, that the specimens be fresh, and luckily there is seldom difficulty in obtaining fresh specimens in military laboratories. Staining and cultural methods were used for a time both in 1932 and 1933, but were given up as impracticable for routine use where large numbers of cases are being dealt with simultaneously. The day is not long enough to devote time to such methods and at the same time make sure that the bacteriological diagnosis of each case is not being neglected. Yet without them some diagnosis must be made. At the moment, in our military laboratories the criterion of pathogenicity is the presence inside the amœba of ingested red blood-corpuscles. Such amœbæ, the Class I amœbæ of this note, formed only 28·3 per cent of the total numbers of amœbæ found during 1933, and only such amœbæ were regarded as *E. histolytica*. Amœbic dysentery thus diagnosed formed 6·5 per cent of the total dysentery in Quetta in 1933. As this figure is somewhat lower than that commonly accepted as the percentage proportion of amœbic dysentery, it seems likely that a number of amœbic cases were missed, the reason being, in my

opinion, that it was often very difficult to make certain of the fact of hæmatophagy in cases showing amœbæ otherwise resembling *E. histolytica*. In some cases an almost impracticably prolonged search was necessary to find an amœba containing red blood-corpuscles amongst many without red blood-corpuscles, and in others the only evidence of hæmatophagy was indefinite, owing to the effect of digestion on the ingested red blood-corpuscles. As evidence of the difficulty of finding an amœba with contained red blood-corpuscles, the two following cases are quoted.

Case 1.—Senior Medical Officer. A specimen received on the third day of disease was found to contain amœbæ, very active and progressive, pseudopodia blunt, clear, and as wide as the amœbæ, Charcot-Leyden crystals present, and yet at least twenty amœbæ were examined before one could be certain that an undoubted red blood-corpuscle was present in one of them. Subsequent to this, dozens of slides were examined and probably hundreds of amœbæ, and yet only one other showed perfect red blood-corpuscles among its contents. If this had not been a special case it is unlikely that hæmatophagy would have been observed. No bacteriological cause was found in this typical case of dysentery. Relapse occurred seven months later in spite of treatment.

Case 2.—Captain H. Three years' history of dysentery treated in various hospitals with anti-dysenteric serum and salines. Special examination was given him as he was a frequent opponent on the golf links. First specimen showed amœbæ and among them one of the following description: "Amœba 20 μ, fairly active and progressive. Pseudopodia clear, nucleus not visible, contents numerous, including round yellowish bodies about 10 μ, large clear advancing pseudopodia, Charcot-Leyden crystals present." Second specimen on same day showed "amœba streak-like in form and actively progressive, cytoplasm yellowish in places." Third showed "amœba 20 μ, actively progressive, nucleus invisible, contains five undamaged red blood-corpuscles. Numerous other amœbæ." That is, a definite hæmatophagous amœba was not found until the third specimen had been searched. Six microscopes were employed and six observers examined slides simultaneously.

Obviously, therefore, if hæmatophagy alone is to be the standard of pathogenicity, the attention of the laboratory must be concentrated on the one case until it is found.

With regard to the effect of digestion on ingested red blood-corpuscles, the percentage of active amœbæ diagnosed as *E. histolytica* would have been considerably higher if a somewhat broader view had been taken of what exactly constitutes hæmatophagy. Nothing but definite undamaged red blood-corpuscles inside the amœba was accepted as evidence of this. Cases frequently occurred, however, in which bodies of the size of red blood-corpuscles were found. These could not definitely be said to be red blood-corpuscles owing to irregularity of contour, or to slight difference in colour from the red blood-corpuscles outside the amœbæ; or the rounded

bodies inside the amœbæ although of the right colour were perhaps larger or smaller than the normal red blood-corpuscles. There must, of course, be a stage in the digestion of red blood-corpuscles inside the amœba when they cease to be recognizable as such, but information as to the stage at which this occurs, or as to the appearances which this digestion produces in the red blood-corpuscles, is difficult to obtain.

A few cases occurred here this year on which observations on these appearances have been made, and the notes made at the time on their index cards are as follows :—

"September 28, 1933. Case of Dr. H. Numerous red blood-corpuscles in specimen. Numerous active hyaline amœbæ with few contents. These contained red blood-corpuscles similar to those outside the amœbæ, but they also contained red blood-corpuscles apparently in process of digestion. These red blood-corpuscles were of all sizes less than normal. Their outlines were even and regular, and their colour was that of a red blood-corpuscle. Owing to their varying size and in spite of their colour they would have been taken for ingested oil globules, but for the fact of unaltered red blood-corpuscles both outside the amœba and inside it."

"October 27, 1933. Case No. 1039, swarming with *E. histolytica*. Some contain numerous unaltered red blood-corpuscles, others show simply a yellow granular staining, while others show disintegrated red blood-corpuscles as follows : (*a*) Irregularly-shaped particles of the colour of red blood-corpuscles, all less than seven microns in size. (*b*) Rounded bodies of the colour of red blood-corpuscles and varying in size from seven microns down to about two microns. (*c*) Red blood-corpuscles of all sizes less than normal, with crenated edges."

It is obvious, therefore, that many of the amœbæ placed in Class II because they contain bodies resembling red blood-corpuscles are in reality hæmatophagous amœbæ and belong really to Class I. It seems definite also that an amœba may be hæmatophagous and yet show little more than a yellow granular staining as evidence of this. The dictum, therefore, that no amœba should be regarded as *E. histolytica* unless it contains red blood-corpuscles might justifiably be widened somewhat so as to include evidence of hæmatophagy, such as degenerated red blood-corpuscles (?) or even yellow stained areas in the cytoplasm of an amœba which is active and progressive. A wider view of what constitutes ingested red blood-corpuscles would have brought our 28·3 per cent of *E. histolytica* up to about 38·5 per cent of all amœbæ, for the great majority of our Class II amœbæ contained bodies resembling red blood-corpuscles (17 out of 21).

Hæmatophagy alone as the standard, therefore, is not sufficient to define all pathogenic amœbæ unless the laboratory is able to concentrate on each individual case by examining specimen after specimen until it is found. Even then one may have to be content with semi-digested red blood-corpuscles as evidence of this. Even the presence of degenerated red blood-corpuscles, in an amœba which progresses actively by the

extrusion of clear pseudopodia would not, in my opinion, if adopted as a standard, have the effect of including an appreciable number of non-pathogenic amœbæ.

With regard to the non-hæmatophagous amœbæ which progress actively by means of throwing out clear pseudopodia (Class III of this paper) there is a lack of agreement amongst recent writers as to the diagnostic value of two important points generally considered to appertain solely to *E. histolytica*, which otherwise might have given considerable aid. The American writers Toynbee Wight and Prince [2] have shown that *E. coli* also may have clear pseudopodia, and they believe its movements may be just as active as those of *E. histolytica*. One of them actually goes the length of stating that *E. coli* may ingest red blood-corpuscles, which leaves the ordinary man in despair as to the diagnosis of amœbæ in general. Apparently nothing is peculiarly characteristic of *E. histolytica*, except perhaps its nucleus, and that cannot be examined properly except in stained specimens. On the other hand there is the quotation from Wenyon given earlier in this paper, " As regards the large amœbæ from 15 to 20 microns or more, if they occur in dysenteric stools, and are very active, they are probably *E. histolytica*." This in my opinion is the attitude to adopt when treatment has to be considered. Only a protozoologist can say whether such amœbæ actually are *E. histolytica* or not, and in the absence of a protozoologist it seems to be fairer to the patient to give him the benefit of the doubt, and regard such actively progressive amœbæ as being of a pathogenic nature. In the Quetta cases in 1933, 19 out of 28 Class III amœbæ occurred in dysenteric stools, and, therefore, if the writer's interpretation of Wenyon is correct, they were "probably" *E. histolytica*. If one grants this, the proportion of amœbic to other forms of dysentery would be raised from the figure 6·5 per cent based on hæmatophagy, to 12·1 per cent as a result of the inclusion of these active Class II and Class III amœbæ. This figure is somewhat higher than the all India figure from military laboratories (9·7 per cent in 1932) but it is more in accordance with recent writings than the figure 6·5 per cent based on hæmatophagy alone.

The amœbæ found in the various classes were distributed amongst the different varieties of dysentery and diarrhœa as shown herewith.

	Class I	Class II	Class III	Class IV	Total amœbæ	Cases without amœbæ
Bacillary dysentery ..	26	5	8	25	64	384
Clinical dysentery ..	19	13	13	28	73	169
Diarrhœa	2	3	7	17	29	352
	47	21	28	70	166	

It will be seen that out of forty-seven hæmatophagous amœbæ, no fewer than twenty-six were found in cases which showed evidence of bacillary infection either by the presence of a bacillus of dysentery or in the character of the exudate. That is, more than half of the cases of amœbic dysentery in 1933 occurred in the form of a mixed infection.

PART II F.

Relapses.—It is not easy to give a definition of what constitutes a relapse in dysentery. An attack due, for example, to *B. dysenteriæ* Flexner "X" may be followed shortly afterwards by another attack during which *B. dysenteriæ* Flexner "V" is isolated. Clinically this may be a relapse, bacteriologically it is not.

Similarly with regard to time, an attack caused by *B. dysenteriæ* Flexner "V" may be followed in a few months by another attack due to the same organism. This may be a relapse, but there can be little proof that it is not a fresh infection.

Another difficulty arises from the widely different incubation periods of bacillary and amœbic dysentery, so that the subject becomes very complex. While the incubation period of all forms of bacillary dysentery is probably within one week, the incubation period of amœbic dysentery may be anything from two weeks to two or three months, according to the experience of Walker and Sellards [3], who administered *E. histolytica* cysts to certain prisoners. Therefore, a clinical relapse of dysentery two months after the first attack may possibly be an amœbic infection implanted at the same time as the bacillary infection which caused the first attack. Such cases were, however, uncommon in 1933, only one out of thirty-eight "relapses" within a period of three months showing *E. histolytica* in the second attack after an earlier bacillary infection.

During 1933, as was to be expected, amœbic dysentery cases were more liable to a second attack of dysentery than non-amœbic cases. For example, of the 47 cases already mentioned, no less than 17, or 36·1 per cent, suffered a second attack within one year, while of 643 cases in which *E. histolytica* was not found, the number was 84, or 13 per cent.

On the other hand, the great majority of cases in which second or multiple attacks occurred were not amœbic at all, owing to the low incidence of amœbic dysentery as compared with bacillary. During 1933, 101 cases of dysentery had a second or multiple attack of dysentery or an admission to hospital for diarrhœa shortly before or after their admission for dysentery. Of these :—

E. histolytica were found in	14	= 27 per cent.
E. histolytica cysts were found in..	3	
Amœbæ, Class II, were found in	4	
Amœbæ, Class III, were found in..	6	
But no amœbæ at all were found in	74	= 73 per cent.

Another point of importance from which it is possible that an inference may be drawn is the length of time between the attacks in cases of double or multiple attacks of dysentery. The great majority of second attacks occurred within three months of the first, and, of these, most occurred within one month after admission for the first attack. For example :—

	1932	1933
Recurrence in one month	38	24
Recurrence in two months	7	6
Recurrence in three months	4	8

These figures refer to cases in which an attack of dysentery was followed by a second attack of dysentery, and if one adds to these those cases in which one of the attacks was apparently only diarrhœa a similar table may be prepared as follows:—

TABLE.

DYSENTERY RELAPSES, 1933.

1st attack		2nd attack	Within 1 month	Between 1 and 3 months	Between 3 and 12 months
Dysentery bacillus	followed by	dysentery exudate	4	2	4
Dysentery exudate	,, ,,	dysentery bacillus	5	—	5 (*a*)
Dysentery bacillus	,, ,,	dysentery bacillus (same type)	3	3 (*a*)	1
Dysentery bacillus	,, ,,	dysentery bacillus (different type)	3	3	3
Dysentery exudate	,, ,,	dysentery exudate	5 (*b*)	2	4 (*a*) (*b*)
E. histolytica	,, ,,	dysentery exudate	1	1	1 (*c*)
Dysentery exudate	,, ,,	*E. histolytica*	1	—	—
E. histolytica	,, ,,	dysentery bacillus	—	2	4 (*a*)
Dysentery bacillus	,, ,,	*E. histolytica*	2	1	2
E. histolytica	,, ,,	*E. histolytica*	—	—	1
			24	14	25

DYSENTERY-DIARRHŒA RELAPSES, 1933.

i.e., dysentery one attack, diarrhœa in the other.

1st attack		2nd attack	Within 1 month	Between 1 and 3 months	Between 3 and 12 months
E. histolytica	followed by	diarrhœa	—	1	—
Diarrhœa	,, ,,	*E. histolytica*	2	—	—
Dysentery exudate	,, ,,	diarrhœa	5 (*c*)	2	1
Diarrhœa	,, ,,	dysentery exudate	5 (*d*)	3	2
Dysentery bacillus	,, ,,	diarrhœa	9	3	3
Diarrhœa	,, ,,	dysentery bacillus	1	1	—
			22	10	6

(*a*) Associated with one Class III amœba.
(*b*) ,, ,, two cases showing *E. hystolytica* cysts.
(*c*) ,, ,, one case showing Class II amœba.
(*d*) ,, ,, one Class II amœba and one *E. histolytica* cysts.

The figures show number of cases.

Double attack of dysentery or an attack of dysentery and of diarrhœa in 1933.

Within one month	..	46
,, two months	..	14
,, three ,,	..	10
,, four ,,	..	6
,, five ,,	..	6
,, six ,,	..	2
,, seven ,,	..	1
,, eight ,,	..	2
,, nine ,,	..	1
,, ten ,,	..	6
,, eleven ,,	..	1
,, twelve ,,	..	6
		101

It appears reasonable to doubt, from the large numbers of readmissions within one month, if the treatment of the initial attack had been sufficient. The numbers of such cases are not inconsiderable, for 6·6 per cent of cases were readmitted within one month, and a total of 10 per cent within three months.

When one comes to consider the bacteriological findings in the double or multiple attacks in each individual, one is led into difficulty at once. The table shows the laboratory findings in all cases in which more than

one attack of dysentery occurred in 1933, or in which an attack of dysentery was followed or preceded by an attack of diarrhœa. Those in which the two attacks occurred within one month are shown in column 3, while columns 4 and 5 show those in which the subsequent attack occurred between one and three months, and between three and twelve months respectively after the first attack. The extraordinarily varied nature of the laboratory findings is evidenced by the complexity of this table. Herein lies the difficulty, for in the majority of these cases it is impossible to say that relapse has occurred, although there is little doubt that the clinician and the patient would regard a second attack within two or three months of the first as being likely to be of the nature of a relapse. In only a very small minority of the cases were the findings of the first attack repeated in the second attack, and in only one case was a finding of *E. histolytica* in the first attack followed by a finding of *E. histolytica* in the second attack.

The laboratory findings in the non-amœbic cases were so varied that comment on them can only be of a speculatory nature. Only seven showed a finding of the same type of dysentery bacillus in the two attacks, and in these even there can be no proof that fresh infection had not occurred. The majority of the cases showed no apparent continuity of infection, and all that can be said of them is that they had two or more attacks within a year. Whether this was because they were more exposed to infection than normal, or more susceptible than normal, or whether the second attack was a relapse of the first in spite of the different laboratory findings, it is impossible to say. Several cases which were closely followed throughout the year showed the most extraordinary findings; for example :—

Case B. showed *B. dysenteriæ* Flexner type 170 in June, *B. dysenteriæ* Flexner type 88 in July, indefinite exudate in August, and a return to *B. dysenteriæ* type 170 in September.

Case C. J. showed *B. dysenteriæ* Sonne in June, another attack due to *B. dysenteriæ* Sonne in July, *B. dysenteriæ* Flexner (Andrewes type) in August and indefinite exudate in September.

Case H. showed *B. dysenteriæ* Flexner (Andrewes) in May, bacillary exudate in June, indefinite exudate in September, and a return to *B. dysenteriæ* Flexner (Andrewes) in October.

These cases do not show the continuity of infection one might expect in such frequent relapses. It appears almost as if a single organism were responsible in each case, appearing in a different form according to its environment at the time.

PART II G.

Mixed Infections.

Those mixed infections, in which a bacillary and an amœbic infection were acquired at the same time, so that a primary bacillary attack was followed some weeks later by an amœbic attack, were rare, only one out of forty-seven cases of amœbic dysentery in 1933 giving evidence of such a possibility.

The remainder of the cases, 29 in number, in which evidence of bacillary dysentery and of amœbic dysentery was discovered in the one attack, may be divided into two: (1) Those in whom hæmatophagous amœbæ were discovered in an attack of dysentery during the course of which a bacillary exudate was noted. These numbered 13. (2) Those in whom definite proof of the mixed infection was afforded by the isolation of a dysentery bacillus in the course of an attack in which also hæmatophagous amœbæ were found. These were 16 in number.

Altogether 30 cases of mixed infection of amœbic and bacillary dysentery occurred in 690 cases, a percentage of 4·3. The association in one illness of the causative agents of amœbic and bacillary dysentery, where no previous disability was noted by the medical officer, probably means that the bacillary infection took place during the incubation period of the *E. histolytica*, and probably that the developing amœbic infection gave rise to an increased susceptibility to any bacillary infection which happened to be prevalent. This as a matter of fact appears to have happened in more than half of the amœbic cases in 1933, for no fewer than 62 per cent of the cases in which hæmatophagous amœbæ were found showed in addition evidence of a bacillary infection, either by the isolation of a dysentery bacillus or by the finding of a bacillary exudate. The amœbæ were usually found on the second or third day of the disease and seldom occurred in the bacillary exudate itself, possibly I think because such exudates were not searched as thoroughly, and partly certainly because an amœba does not stand out so clearly in a preponderance of pus cells and is therefore liable to be missed.

The organisms associated with these hæmatophagous amœbæ were as follows: *B. dysenteriæ* Flexner (type 88 Boyd) 6 cases; *B. dysenteriæ* Sonne, *B. dysenteriæ* Flexner (type 170 Boyd), *B. dysenteriæ* Flexner 2 cases each; *B. dysenteriæ* Shiga, *B. dysenteriæ*, Schmitz and *B. dysenteriæ* Flexner (inagglutinable) 1 case each.

Such are the mixed infections in which definite *E. histolytica* were associated with bacillary dysentery (4·3 per cent). A further 18 cases occurred in which the bacillary infection was accompanied by the presence of Class II and Class III amœbæ, so that the maximum number of cases in which it could be said that a possible mixed infection had occurred was 6·9 per cent.

SUMMARY.

(1) One hundred and sixty-six cases suspected of dysentery in Quetta were found to contain amœbæ of a size similar to that of *E. histolytica*. These were arranged into four classes, depending on the characters of the amœbæ in fresh specimens.

Class I. The amœba contained undamaged red blood-corpuscles, 28·3 per cent.

Class II. The amœba was active and progressive with clear pseudopodia. It contained bodies resembling red blood-corpuscles, or *E. histolytica* cysts developed during convalescence of the patient, 12·6 per cent.

Class III. The amœba was active and progressive, 16·8 per cent.

Class IV. The amœba showed none of the above characteristics normally found in *E. histolytica*, 42 per cent.

Cases showing hæmatophagous amœbæ, i.e. Class I, formed 6·5 per cent of the total dysentery. If Class II amœbæ are accepted as *E. histolytica*, the proportion of amœbic dysentery would be raised to 9·8 per cent.

It is considered that active and progressive amœbæ occurring in dysenteric stools should in the interests of the patient be regarded with great suspicion, if not actually treated as *E. histolytica*. Their inclusion as pathogenic amœbæ would have raised the proportion of amœbic to other forms of dysentery to 12·1 per cent.

(2) Twenty-six out of forty-seven cases showing definite *E. histolytica*, also showed evidence of bacillary infection. That is, amœbic dysentery occurred more frequently in association with bacillary dysentery than as a separate entity.

(3) Of the total dysentery, mixed infections of bacillary and amœbic dysentery occurred in 4·3 per cent of the cases as a minimum figure and in 6·9 per cent of the cases if all the actively progressive amœbæ described were considered pathogenic. In the majority of cases the evidence suggested that developing or symptomless amœbic dysentery may have been a predisposing cause of the onset of the bacillary infection.

(4) Definite relapses of dysentery in which the laboratory findings in the two attacks were the same, were very few. Out of 101 cases of double or multiple attacks within one year, seven showed the same organism in the two attacks, one showed *E. histolytica* in the two attacks.

In the remainder of the cases the causative organism was not isolated in one of the attacks, in spite of careful and efficient laboratory examination. It is impossible to say whether such cases were relapses or fresh infections. They may have been of the nature of a chronic infection with exacerbations, in which it is always difficult to isolate the causative organism.

(5) Double or multiple attacks of dysentery occurring within a space of one year showed *E. histolytica* in 17 per cent of cases and active progessive amœbæ in a further 10 per cent of cases. The majority of double or multiple attacks were bacillary in origin.

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REVIEW OF FEVERS OF THE TYPHUS GROUP (VECTOR UNKNOWN) OCCURRING AT AHMEDNAGAR DURING 1933.

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The following figures indicate the number of cases treated during 1931 to 1933 at the British Military Hospital and Families Hospital, Ahmednagar. Available records indicate that no such fevers were admitted in 1931. There is an increase of five cases in 1933 as compared with 1932.

	1931	1932	1933
Officers	0	1	1
B.O.Rs.	0	4	8
Women	0	0	2
Children	0	3	2
Total ..	0	8	13

A seasonal incidence would seem to be indicated by the following figures :—

	1932	1933
January..	0	2
August	0	2
September	1	3
October..	3	0
November	3	3
December	1	3
Total ..	8	13

This might be attributed solely to the fact that in the training season there is more exposure to infection. In this connection a review of the Training Camps for the last three years is of interest in that certain sites gave a high rate incidence when used as Battalion Training Camps in November, but when used after the middle of January as Brigade Training Camps the rate incidence was *nil.* Again, the incidence among the women and children is also confined to the last four months of the year. There is no record at this station of any case occurring after the middle of January until August. The figures from the Indian Military Hospital are two cases in October, 1931, and two cases in October, 1933. These facts would appear to indicate a seasonal limit for the disease.

Immunity.

Nothing definite has been ascertained in this connection other than that there are no recorded cases of a recurrence among Europeans at this station and that the natives in areas where infection is known to have occurred frequently do not appear to suffer again from the disease.

Age and Sex.

Males predominate in the proportion of 11 to 1. The average age is 24 years, the youngest 5 and the oldest 52, but this is not regarded as having any ætiological significance.

Distribution.

Vilad	4 cases	*Outside Cantonments*	
Bahisht Bagh	2 cases		
Loni	1 case	Total	9 cases
Shivgaon	1 case		
Grass Farm	1 case		
Sandhurst Barracks	3 cases	*Within Cantonments*	
Napier Barracks	1 case	Total	4 cases

Remarks as to Cases occurring outside Cantonments.

It will be noted that over half these cases arose from two known areas—Vilad and Bahisht Bagh.

Vilad is situated nine miles from Cantonments on the Rahuri Road, and is characterized by a luxuriant growth of unusually large mango trees, and a nullah flooded in the rains. Water is present until the hot weather: the vegetation is more abundant than in the surrounding districts, and herds of buffaloes frequent the site. It is specially popular for training camps and picnic parties.

Bahisht Bagh is situated four miles from Cantonments on the Rahuri Road. It is an old ruined palace surrounded by mango trees and luxuriant undergrowth, a stream is present and herds of buffaloes frequent this site.

It will be noted that both sites have certain common features in that mango trees, water, buffaloes and rank vegetation are present. A review of past cases occurring at this station indicates that one or more of these features is associated with the movements of the patients just prior to the onset of the disease; this has been the rule in all the twenty-one cases of which records are available. One feature common to all the cases is that the patient has invariably been in close proximity to herds of buffaloes or has been at a site frequented by herds of buffaloes.

Remarks on Cases occurring within Cantonments.

Sandhurst Barracks and the Adjoining Area.—The three cases occurring at Sandhurst Barracks within Cantonments may definitely be assumed to have contracted the disease in this area as none had been out of it for at least a month previous to the onset. Sandhurst barracks are situated on the extreme eastern boundary of Cantonments, approximately three and a half miles from the centre. The area is more or less isolated from the rest of Cantonments and is surrounded by almost exclusively fallow land which is frequented at all times by herds of buffaloes. The influx of buffaloes is a marked feature during the rains and after, and this is the period in which these cases have arisen. Through the area runs a large nullah, Darewadi Nullah, which is flooded during the rains and water is always present

there; in the upper part of its course buffaloes wallow, and lower down a swimming pool for the men is usually temporarily made. A smaller tributary nullah runs within 100 to 150 yards from the barrack rooms and is much frequented by buffaloes, a fact which has been a considerable obstacle in plans for dealing with this nullah from the anti-malaria standpoint.

The association of these fevers with the presence of buffaloes is further borne out by the history of one of these three cases. The patient was an officer's child. The family had never permitted their compound to be rented for the grazing of buffaloes during the whole of their tour in India until last August, when they permitted fifteen buffaloes to graze in their compound. The grazing continued more or less intermittently until shortly before the child became ill. The child has always been very carefully watched and usually played in the garden and compound but has been for walks in and about both nullahs. The other two cases had also been in this area shortly before the onset of the disease, and this has been the only noteworthy feature of their previous movements.

Napier Barracks.—This area is more or less well within the Cantonments proper and is not isolated to the same extent; it is therefore not subjected to the influx of buffaloes as grazing facilities and water are not present to anything like the same degree as at Sandhurst Barracks. Only one case occurred from this area during the year.

Vector.

Of the 13 cases occurring during 1933, 6 can record no history of having been bitten by any insect prior to the onset of the disease. Of the remaining 7 cases, 2 had a vague unreliable history of mosquito bites shortly before the onset of the fever. Three cases had a definite history of a single bite on one or other leg which was sufficiently severe and painful to draw their attention to it at the time, but no insect was found. All these bites occurred two to three days before the onset of the disease. The remaining 2 cases had a very definite history of a tick bite shortly before the onset. Both these cases found the tick. These last 2 cases occurred together with 2 others among the 1st Battalion Royal Fusiliers while on battalion training in camp at Vilad. Thus of 4 cases occurring in succession from the same area, half of the number have a definite history of a tick bite. Earlier in this review attention was drawn to the fact:—

(1) That over half the cases during 1933 arose from two localities which had certain features in common which differentiated them from the surrounding country—water, rank vegetation, mango trees and buffaloes.

(2) That all cases of which records are available at this station have, in the history of their movements prior to the onset of the disease, a record of having been in the vicinity of water in an area frequented by buffaloes.

It is thought that such areas attract cattle for water and shade. These cattle are all tick ridden, and it is suggested that the area becomes to a

greater or lesser extent tick infested. It has been noted on examining buffaloes before and after they enter water that on emerging numerous ticks have loosened their holds on their hosts and are easily shaken or brushed off the animals. This might explain the frequency with which these fevers are associated with the banks of streams in areas frequented by buffaloes. Again, the trees which are usually present afford facilities for the cattle to scratch their backs and doubtless a certain number of ticks are shed in this way. Further, the rank vegetation would facilitate tick infestation.

The fact that at three inspections of these sites no ticks have been found other than on the cattle might appear to negative the above suggestions. But the incidence rate, while being notably high for these localities, is, generally speaking, extremely low compared with that of other diseases in which a biting insect is known to be the vector. The logical inference must be that whereas these areas are more conducive to infection than the surrounding country (even at these sites human contact with a vector is extremely rare), the vector, by comparison with other biting insects, must be uncommonly hard to find. Finding no ticks on the ground at these sites is therefore only in accordance with what one would expect from the rate incidence and indicates nothing more than bad luck. Further, when these inspections were made the water in the nullahs was extremely low and facilities for cattle to bathe did not therefore exist. A fair trial would necessitate frequent inspections during the months in which this disease is known to occur.

The reasons why the tick is considered to be the likely vector of these fevers and why attention is being mainly directed to it are as follows:—

(1) The original suggestion that the tick was the vector.

(2) That of the twenty-one cases occurring here of which records are available, the only cases in which a bite has been recorded and its cause found have been tick bites, and the disease in these cases has followed rapidly on the bite.

(3) Other cases have occurred in the same locality and at the same time as those in which there is a tick-bite history.

(4) All cases have a history of having been in the vicinity of herds of cattle shortly before the onset of the disease and ticks are the characteristic and predominant biting insects found on these cattle. In this respect it is noteworthy that the cases occurring within Cantonments arise when the cattle are allowed in for grazing purposes; further, that those cases occurring outside Cantonments have invariably been associated with areas frequented by cattle.

(5) In all cases there has been no history of contact with any biting insects other than mosquitoes, and the theory of the vector being a mosquito seems unreasonable from the start, otherwise one would expect a different distribution and a very much higher incidence rate.

(6) No more feasible suggestions as to a vector have been offered.

Incubation Period.

On November 13, the 1st Battalion Royal Fusiliers arrived at Vilad for Battalion Training, having left Cantonments that morning. They remained there until the 29th (sixteen days) when they proceeded for Brigade Training to Loni, which they reached on the 30th.

Five cases occurred in this battalion between November 13 and December 7 (twenty-six days).

Cases 1 and 2 were bitten by ticks on November 15 and 20 respectively, while at Vilad; they reported sick on December 7 and 6 respectively, an interval of twenty-one days and sixteen days from the dates of the bites.

Cases 3 and 4 have no history of a bite; they reported sick on November 26 and 27 respectively, while the battalion was still at Vilad, an interval of fifteen days and sixteen days from the date on which they first arrived at Vilad.

Case 5 went sick on December 5 at Loni Camp—an interval of twenty-three days from the date on which he left Cantonments. These facts would seem to indicate an average incubation period of fifteen to sixteen days with a maximum of approximately twenty-one days.

Other cases with histories of bites have had shorter incubation periods, two or three days being the minimum.

It would appear therefore that the incubation period is on the average sixteen days, though extremes of twenty-one days and two days occur.

Course of the Disease.

(1) *Prodromal Stage.*—(Twenty-four to forty-eight hours.) This is a feature occurring in most of the cases. Sub-occipital headache tending to radiate to the back of the eyes, intermittent at first and later constant, associated with a general malaise. Occasionally there may be a transient pyrexia, but in such cases the temperature falls to normal before the onset. An attack of vomiting may occur but is unusual.

(2) *Stage of onset.*—(Twenty-four to forty-eight hours.) Usually of forty-eight hours duration; is ushered in with a rigor and occasionally a transient attack of vomiting. A rigor associated with pyrexia is the common initial symptom. There is an increase in the headache previously complained of and gradually the feeling of general malaise is replaced by pains in the joints and a generalized myalgia which gradually increases. It is not uncommon for the pain to commence in one joint, but generally three or four joints are involved. However, within twelve to twenty-four hours generalized joint pains are present. The myalgia may also commence as localized pains but rapidly becomes generalized. The regions most affected are the joints of the upper and lower extremities, the muscles of the thigh and back are particularly and constantly affected. These symptoms may be acute, sub-acute, or in some cases entirely absent, so that within twelve to twenty-four hours after the patient has reported sick with

fever the rash appears. Such cases have had what must be a short incubation period which seems to have the effect of masking or eliminating the earlier stages and it was noted that the fastigium in such cases appeared milder than in those cases in which the incubation period would seem to have been longer. In cases in which the fever has run an acute or subacute course, the symptomatology of the onset produces a clinical picture very suggestive of dengue fever; indeed many have been diagnosed as such, until the appearence of the rash made the diagnosis clear. It has been usual for patients to report sick at about this stage; cases reporting forty-eight hours earlier have generally been found to be apyrexial, suggesting the prodromal period indicated above.

(3) *The stage of fastigium.*—(Nine days). Within twenty-four to forty-eight hours of the onset there is usually a sudden rise in the temperature, but occasionally the rise may be of the gradually ascending type reaching its maximum about the third day, within six to twenty-four hours of the appearance of the rash, which is seen first between the third and the fourth day of the fever (first or second day of the fastigium). Pyrexia is of the swinging type, on the average from 100° F. in the morning to 103° F. in the evening, but not infrequently the morning temperature may be normal. Generally the temperature swings between 100° to 103° F. for nine days. The appearance of the rash does not alter markedly the degree of pyrexia beyond in some cases an initial rise just before the onset of the rash, after which it falls to within the 100° to 103° F. range. Somewhere between the eighth and the tenth days, generally about the ninth, the gradual descent of the temperature commences and the fever passes into the stage of defervescence.

There is little noteworthy in the symptomatology of the fastigium. Headache, joint pains and myalgia are present to a greater or lesser degree, depending upon the severity of the attack and the response to treatment.

Frequently there are few or no symptoms, the patient remaining quite cheerful, and apparently unaffected by the fever and requesting a full diet. Other cases, especially those with a profuse rash, have been noted to show signs of marked exhaustion invariably associated with tremors of the hands, suggesting an acute toxæmia. Cyanosis of the lips, lobules of the ears and finger-tips has occurred in some of the more acute cases but this has been the exception; when it does occur it persists for a considerable time but no cardiac involvement is apparent. Vomiting and delirium have not been recorded at this stage. There was nothing noteworthy as regards the excreta; the bowels have a natural tendency to be constipated and the urine highly coloured as would be expected. There is no tendency to unusual sweating and profuse sweats have not been noted. On examination, other than the rash there is nothing to be discerned, enlargement of the liver and spleen has not been noted and the lungs have shown no tendency to congestion.

Examination of the central nervous system reveals nothing organic. A fine involuntary tremor, presumably functional, involving the upper and lower extremities, is invariably present ; a coarser intention tremor occurs towards the end of the fastigium and persists for many months afterwards, but where it has been possible to keep the patient under observation it has been noted that this tremor gradually diminishes and eventually disappears, leaving no sequelæ.

(4) *The stage of defervescence.*—(Five days.) About the ninth day the temperature commences to descend from its high plateau, reaching normal by a gradual lysis in three to five days, usually five days, though it may be prolonged for eight days. There is nothing noteworthy in the symptomatology of this period. There is a gradual improvement in the patient's condition, headache and the joint pains gradually subside, and by the sixteenth day of the disease have entirely vanished. The rash on the other hand deepens during this stage when its character is best seen. By the sixteenth day of the disease the fever has usually completely subsided though it may persist for two or three more days—but this is exceptional. The patient's condition is on the whole very much better than one would expect after so prolonged a fever. There is no evidence of any organic lesion in the heart or kidneys and the patient, beyond being somewhat exhausted, complains of nothing and is usually able to get out of bed ten days after the end of the fever. By the end of a fortnight he is fit for discharge but is incapacitated for any duties for approximately a month.

(5) *Sequelæ.*—Most cases recover without any sequelæ, but patients of a neurotic diathesis appear to be precipitated into a definite neurasthenia which in the case of soldiers may result in their being invalided for this disease. Loss of hair is another sequela usually following within a month of the patient's discharge from hospital. The condition is transitory and close clipping of the hair appears to remedy the condition.

(To be continued.)

HIS MAJESTY'S ROYAL PALACE AND FORTRESS OF THE TOWER OF LONDON.

By Colonel N. J. C. RUTHERFORD, D.S O.

The Tower of London has for so long a time been familiar to all members of the public as a show place, a museum of old armour and instruments of war, an ancient monument holding the history of the British peoples behind its grim grey walls, that the correct designation and administration of the Royal Palace and Fortress has almost been lost sight of in its more popular role as "one of the Sights of London." Fortress first, then residence of Monarchs until Queen Elizabeth refused to live as a Queen in a place where she had spent months as a prisoner, then a State Prison for great offenders, and now again a Fortress and a Museum. The Fortress covers 12 acres. The garrison consists of a battalion of the Guards Brigade, quartered in the Waterloo Barracks built under the orders of the Duke of Wellington. Various ancillary services are represented in the Ordnance Officer's Staff and the Barrack Warden. All the buildings in the Tower are under the supervision and care of His Majesty's Office of Works and Public Buildings, so that construction work or repairs of the buildings occupied by the military garrison is carried out by the Office of Works, but no new work can be commenced in the Tower without the favourable opinion of the Constable of the Tower who will submit the matter to the King for approval. The duties of the garrison are concerned with their own battalion training and in carrying out the various guards and ceremonies in accordance with the immemorial customs handed down the ages. The Guards are Garrison Guards and are three in number: the Main Guard situated near the Bloody Tower and close to the Jewel House, the Spur Guard at the entrance gates, and the Wharf Guard at the Tower Bridge end of the Wharf overlooking the river. It is the Main Guard which furnishes the escort each night at 10 p.m. for the ceremony of the King's Keys. The Spur Guard has the responsibility of becoming familiar with all the Tower residents, as it is part of their orders to stop and question all strangers after the Tower is closed to the public, and to detail a soldier to accompany any such stranger wishing to visit any resident. The Guard for the Bank of England is not supplied from the Tower Garrison. The administration of the Tower is vested in the hands of the Constable, who holds his appointment by Royal Letters Patent under the Great Seal. The Constables date back to one Geoffrey de Mandeville, created by William the Conqueror about 1078. Since 1826, when the Duke of Wellington held the title, it has been almost invariably given to officers holding the rank of Field Marshal. It is centuries since the Constable resided in the Tower. The second appointment is that of Lieutenant of

the Tower. The first Lieutenant recorded is William de Piuntel, 1189, in the reign of Richard I. From the time the Constable gave up residence the Lieutenant became the most important official, and in the reign of Henry VIII a new house called the Lieutenant's Lodgings was built on Tower Green for his accommodation. This Tudor residence is now known as King's House, and is the home of the officer holding the third appointment as Major and Resident Governor, the Lieutenant having ceased to be in residence since 1689. The appointment of Lieutenant is for three years and is given to Lieutenant-Generals on the active list but not holding commands. The Major is now therefore the only administrative resident officer, and he carries out the orders of the Constable, who is in supreme command, or the Lieutenant, who is second in command. Of late years the appointment of Major has been given to a retired Lieutenant-Colonel, and carries with it residence in the King's House. This third appointment dates back to 1690 in the reign of William and Mary.

But the most important of all officials in the Tower is the Keeper of the Jewel House. This ancient title dates back to somewhere about 1042 in the reign of Edward the Confessor, but the earliest holder of the appointment named was the Bishop of Carlisle, in 1230. The Keeper has an official residence in St. Thomas' Tower, and is a member of His Majesty's Household, under the direct orders of the Sovereign, issued through the Lord Chamberlain. Since 1852 the office has been delegated to a retired officer, and the last six have held the rank of General. Two more residential appointments exist: that of Chaplain to the Tower and Medical Officer to the Tower. During the last decade the Chaplain-General of the Army has occupied the post of Chaplain and been given a house on Tower Green, next to the Church of St. Peter ad Vincula. The Medical Officer has been of late years a re-employed R.A.M.C. (R.P.) officer appointed by the War Office and approved by the Constable. Before the Great War, R.A.M.C. officers on the active list were posted to the Tower, though in earlier years the post was held by officers of the Medical Department on half pay. The Army List of 1874 shows a Deputy Inspector-General Ivey at the Tower, and a brass plate in St. Peter ad Vincula commemorates this officer's service in the Tower from 1871-1891.[1] Before the South African War of 1899, and for some years after, the Guards Brigade had their own medical officers, who lived with the battalion resident in the Tower. In those days the Tower supported two medical officers; the Guards Surgeon, who looked after his own people, and the Tower Medical Officer who looked after the resident officials and Yeoman-Warders and families, and had the official residence marked Medical Officer on Tower Green next to the Chaplain's House. When the Brigade ceased to have their own Surgeons (they still exist in the Household Cavalry) the two duties

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[1] There is no record in the Major's Office of Medical Officers at the Tower.

were merged into one and the resident medical officer of the Tower became responsible medically for all Tower residents. Even as recently as 1929, the Dispensary attached to the Reception Station was situated in the basement of a Yeoman-Warder's quarter, and there still remained the Yeoman-Warder who had acted as dispenser to the medical officer. Also the block of buildings now known and used as married quarters for families of the troops is still shown in old plans as Hospital Block and was a Military or Regimental Hospital. The duties of the resident medical officer (in my time) varied from a routine sick parade at the Medical Inspection Room, or "Medical Bunk" as the Brigade call it, to the treatment of an American tourist bitten by a Tower raven, and to maternity attendance on a lady visitor who overstayed her time, in both senses, and found the Tower gates shut on her at at 11 p.m.

I always thought that the appointment of Medical Officer to the Tower should be permanently graded as one of the six official appointments on a definite scale of pay *with quarters* as is the case with the other resident officials. The Keeper of the Jewel House, Resident Governor and Chaplain are all provided with free residences. The Medical Officer has a sum for rent of his house deducted from his pay as a R.A.M.C. re-employed officer. The Superintendent of the Office of Works resides in the Tower as do also the Chief Clerk to the Ordnance Officer and the Barrack Warden. Then come the Yeomen-Warders; they are recruited from warrant officers and colour-sergeants who have their names registered as candidates when serving with the Colours. The age limit for appointment is 50 and Warders after attaining 60 years of age will be struck off the strength, but may be re-appointed. The medical officer examines all warders over 60 years in January and reports on their fitness for continuing in the Service. The rule of re-appointment is freely exercised and some of the Senior Warders stay on into the seventies. They number 40 and some 35 are provided with free quarters in the Tower.

The Chief Warder, whose correct title is the Yeoman Porter, acts as a Regimental Serjeant-Major, carries out the daily postings for duties and personally takes the nightly ceremony of the King's Keys. His second-in-command is the Yeoman-Gaoler who, on ceremonial occasions, carries the axe of execution, now a large and imposing implement kept in the Major's office. All Yeomen-Warders are sworn as special constables and have police powers. Most of the resident warders have grown-up families of various ages. When the outer gates are locked at 10 p.m., the wicket gates are still open but no cars can enter or leave the Tower. At 11 p.m. all egress from the Tower is closed, and ingress only allowed to those in possession of the password for the night. At midnight the wicket-gate is closed to troops and to all except residents who have entered their names in a special book kept in the Warder's Hall, signifying their intention to be out after 12 o'clock. A Yeoman-Warder remains on duty until 3 a.m. at the Byward Tower wicket-gate and admits those entered in the book.

After 3 a.m. the Tower is closed to all. There is a clause in the Standing Orders of the Tower that the " warder of the watch in case of accident or illness will open the wicket gate for medical aid." In the Warder's Hall there is kept a spare key for the wicket-gate in a glass case: in the event of sudden emergency the glass can be broken and the key used.

As regards health and sanitation. Many people think the Tower must be unhealthy from its situation on the river and proximity to Billingsgate fish market. Certainly sore throats, colds, and, when influenza is about, influenzal colds produce a full sick parade, but not any more so than other London Barracks. As a class the Yeoman-Warders are a healthy lot of men. They have to be out and about in all weathers, yet many of them are active and spry at the late sixties and even early seventies. I do not think fog is any worse than one gets at Millbank. The sanitation of barracks is done by the Office of Work employees, though the general sweeping-up and cleaning of the Tower is done by the troops, no light matter after a public holiday when some six to eight thousand people leave litter scattered all over the place. Incidentally, it always annoyed me to see soldiers used for this purpose.

No description of the Tower is complete without a word about the ravens. It has always been a custom to keep these birds as show exhibits to entertain the visitors. Their origin is obscure. Some say they came to the Tower from the surrounding forests and swamps hundreds of years ago, others that they formed part of the menagerie of the Tower that existed in Tudor days. Anyhow the Tower supports five of these queer birds. They used to be formally taken on the strength and provided with a fully filled-in medical history sheet. They certainly draw a ration of raw meat which is fed to them daily by the sanitary corporal of the battalion. This meat they bury on the green and dig it up again when sufficiently tasty. They frequently amuse themselves by slipping under one of the garden seats on the green and taking a peck at innocent visitors resting thereon. They are attracted by the female leg displayed in a silk stocking, or stockingless, as the case may be. They have a malicious humour of their own, and can be pure devils. If they get a chance they will catch, pluck, and eat a harmless fat London pigeon. Their most annoying habit is their continual hoarse barking; once started they can keep it up for hours, and dawn is the hour they generally choose for their concert. One raven was said to have lived for forty-four years on Tower Green. He died full of vice and wickedness in 1924.

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Editorial.

BRITISH EMPIRE CANCER CAMPAIGN.

In his introduction to the Eleventh Annual Report of the British Empire Campaign Lord Reading, the Chairman of the Grand Council, remarks that it has been pointed out by a very great soldier that every battle is divided into three parts, namely, the period of preparation when openings are being sought for and positions secured, the period of struggle when each side tries to break down the other's resistance, and the final period in which the morale of the vanquished breaks down. Lord Reading believes that the battle against cancer is now entering the second stage. Lines of approach on the enemy's position have been opened up and the main attack is now being directed against the cancer cell itself.

Knowledge about the cell and the chemical reactions that occur within it is increasing and justifies a spirit of optimism. It is thought that when the enigma of the cancer cell has been solved, the last defence will crumble and victory be in sight.

The study of the chemical agents which can produce cancer has been carried out with great success and it is now possible to obtain the cancer-producing substance in pure form and to prepare synthetically a similar product endowed with the same power. A full account of the method by which the previously unknown carcinogenic compound, 1 : 2 benzpyrene, was separated from coal tar and identified by synthesis was published early in 1933. This achievement led to the inquiry whether bodies of similar composition were produced in the human body.

The female hormone, œstrin, which is produced in the ovary, has been found to have a molecular structure rather closely related to the synthetic cancer-producing compounds and early in this year experiments were commenced in which solutions of œstrin were painted on the skin of mice in just the same way as is done with the carcinogenic hydrocarbon. It was noticed that male mice treated in this way showed a great enlargement of the prostate, with obstruction to the flow of urine and distension of the urinary tract up to the kidneys. Dr. Lacassagne of the Laboratoire Pasteur de l'Institut du Radium, Paris, was the first to make this discovery in 1922 and unaware of his work Mr. Burrows and Mr. Kennaway obtained a similar result in their experiments.

The enlargement of the prostate is found to be due to multiplication of cells, accompanied by a considerable change in their character. The appearances are suggestive of the early growth of a tumour, though no claim is made as yet that anything of the nature of a tumour has been produced.

These investigations are being extended on a large scale in the hope that it may be possible to produce a tumour of the prostate experimentally, and Mr. Burrows has begun an inquiry into the possibility that any such

changes in the prostate in man might be due to the action of abnormal amounts of œstrin, which compound is known to be produced in the male body.

The œstrus-producing hormone having been isolated in pure crystalline condition, Dr. Cook and his collaborators prepared a number of synthetic compounds having the same type of molecular structure. Professor Dodds tested their biological activity and found that the active phenomena induced by these artificial products were identical in every way with those shown by the natural hormone. The synthetic substances differ from the natural hormone only in their potency, much larger doses being required to produce the effects observed with a given quantity of œstrin. A very potent compound was prepared from the cancer-producing hydrocarbon, 1 : 2 : 5 : 6-dibenzanthracene, but curiously this substance itself was found to have no œstrus-producing activity, although slight activity was shown by two other cancer-producing hydrocarbons (1 : 2-benzpyrene and 5 : 6-cyclopentons—1 : 2 benzanthracene), by calciferol, and by other compounds closely related to vitamin D. These results are considered to be a clear warning against regarding experimentally-induced biological phenomena as being necessarily due to the particular substances which happen to be produced naturally. It appears that the same substance may have two distinct types of biological activity. The chief function of calciferol is its anti-rachitic action and the chief biological effect of benzpyrene is the capacity to produce malignant tumours. Very large doses of these compounds however are required to produce œstrus compared with those which suffice for their other biological effects.

An observation has been made to the effect that it is possible to convert one of the bile acids normally present in the secretions of the liver into a cancer-producing substance. The changes have been seen *in vitro*, but it has not been proved that they actually occur in Nature.

It has been known for a long time that spontaneous tumours in fowls can be transmitted from one fowl to another by cell-free filtrates. Further investigation showed that tumours could be produced in fowls by tar and synthetic cancer-producing substances in the same manner as in mammals, but at that time these tumours, like those in mammals, could not be transmitted by cell-free filtrates. It was concluded that there must be an important difference between the tumours which could be transmitted by filtrates and those which could not be transmitted. The histological appearance of tar-induced tumours in the fowl was, however, proved to be essentially that of the spontaneous tumours, and last year it was shown that certain of the tar-induced tumours in fowls could be transmitted by filtrates which had passed through a Berkefeld V candle. It has, therefore, been suggested that the property of being transmissible by cell-free filtrates does not belong to the tumour, but to the tissues of the avian host and that, consequently, the cells of the fowl's body differ in some important respects from the cells of the mammal's body.

In the Oliver-Sharpey lectures for 1934, Dr. C. H. Andrewes discusses once more the theory that a virus may be the cause of a cancer tumour. Arguments in favour of the theory are that cell-free filtrates from Rous's sarcoma can produce a new growth in fowls and in a foreign bird, like a pheasant or duck; that neutralizing antibodies are found in the sera of fowls which have borne chronic tumours for at least five months; and that by filtration of the Rous virus through Dr. Elford's colloidal membranes it has been determined that the virus is of the order and size of the larger viruses previously measured. Moreover, the fowl-tumour agent resists heat, acidity, desiccation, and a number of disinfectants much as viruses in general do. It is admitted that mammalian tumours have not yet been transmitted by cell-free filtrates and that human tumours and the transplantable tumours in mice and rats maintain their individual characters from generation to generation. Fowl tumours transmissible by cell-free filtrates show extraordinary diversity from tumour to tumour, and the same constancy of character when a tumour is propagated in series. When tar or other agents initiate malignant changes in the cells of a normal mammal or bird, no virus is introduced; the virus must be there already. Rous showed that if a virus is responsible for tar tumours it cannot have reached the mouse from outside during the period of tarring. The tar can only have enabled the virus to cause pathological changes in the cells.

Dr. Andrewes thinks it may be possible before long to obtain pure suspensions of the Rous virus particles, to agglutinate them with anti-serum, to measure them, and even photograph them. Such things have been done for other viruses of similar size, and if accomplished for fowl-tumour viruses, mammalian tumours could then be studied on entirely novel lines.

In last years' report from the Cancer Research Laboratory, London Hospital, Dr. Thomas Lumsden stated that a number of inoperable cases of human cancer had been treated by the inoculation of concentrated anti-serum. In every case except one, the tumour lessened in size and there was a temporary diminution of pain, but in none of the cases had complete disappearance of the growth resulted.

Since the anti-serum was not strong enough to effect complete cure, efforts were made to concentrate and refine the anti-cancer serum drawn from an immunized sheep. It had previously been shown that during fractioning of the serum, the anti-cancer bodies adhere to the serum protein fraction called "euglobulin." It was now found that the euglobulin precipitated in the middle portion, between the pH 6·4 and 6·1, is richest in anti-cancer bodies. When the middle fraction of the euglobulin is mixed (at pH 4·5) with aluminium hydroxide—C gamma, the anti-cancer bodies adhere to this reagent from which they can be removed in a purified state by the addition of phosphate buffer at pH 7·5 and centrifuging. The

antibodies are found in high concentration in the supernatant fluid; from this they can be precipitated with so little admixture of the poisonous proteins that fifty times as large a dose of anti-cancer bodies can be injected safely as when the original and much more toxic anti-serum was employed. It is hoped that this refined and concentrated product will give better results in the treatment of actual tumours.

Dr. Lumsden found that when the refined euglobulin was kept in a moist state it rapidly lost its anti-cancerous power. It was thought the presence of water might account for this loss, so the euglobulin was exposed to phosphorus pentoxide in a vacuum desiccator until it became absolutely dry. By repeated tests it was shown that if kept in this dry state at a low temperature the euglobulin retained its potency for three or four months. This period allows sufficient time to test the sterility and the actual strength of each individual sample of serum and so to decide whether it is likely to give good results or not.

Experiments have been commenced to determine the chemical nature of the anti-cancer bodies: various digestive agents (enzymes) are being used and the work involves complicated biochemical processes. The results will be published shortly.

Dr. Lumsden states that the latest and most fundamental advance that has been made is the conclusive proof of the existence of anti-cancer bodies which have a lethal effect on the cancer and which are quite harmless to all the normal tissues of the body in which the cancer is growing. The proof is shown conclusively by applying immune rat's serum to cultures of Jensen's rat sarcoma cells *in vitro.* The serum produced by the injection of actively migrating sarcoma cells into rats must be drawn early, preferably on the third day, and applied directly after it has been prepared to young (twenty-four hours old) actively growing J.R.S. cultures. A strong serum kills the J.R.S. cells in ten to twenty minutes. The cells swell up, their nuclei become sharply defined and shrunken, and the fatty and protoplasmic granules agglutinate. If stained after twenty-four hours complete chromatolysis is seen to have taken place. Control sera from normal rats similarly drawn and applied have no damaging effect on the J.R.S. cultures.

These facts are of great scientific interest, but it is clear that no treatment on these lines is at present available for cancer cases.

The discovery of a cancer-producing body has been claimed by Dr. W. von Brehmer. He has described an organism "syphonospora polymorpha" which he has obtained from the blood of cancer patients and of animals bearing a malignant growth and also from human and animal tumours. In the blood the organism is attached to the blood corpuscles from which it can be detached by a "special subcutaneous injection." The organism is a pleomorphic aerobe and is stated to have an invisible phase in which it passes through a membrane filter. Non-pathogenic forms are described in

the blood which can exist with a pH of 6·5 to 7·2. With a pH of 7·4 to 7·6 tubules filled with spores are formed—these are the pathogenic forms and the spores when liberated in the blood enter the damaged cells, penetrate the nucleus and produce the malignant change. Schilling with von Brehmer's assistance has succeeded in obtaining pure cultures of the tubular forms from human and animal malignant disease, but has failed to produce malignant new growths by the injection of pure cultures.

The existence of an alkalosis in cancer has been denied by competent observers and von Brehmer's statements have met with criticism in Germany. Until definite confirmatory evidence has been obtained the claims of von Brehmer must be received with the greatest reserve, and the possibility of successful treatment based on his conceptions must, for the present, be rejected.

It has been known for a long time that lead is absorbed preferentially by cancerous tissue, but unfortunately the drawback to the use of either colloidal lead itself or common lead salts is that the metal when in the ionized state acts on the healthy as well as the cancer cells.

For the past five years Professor Heilbron of Liverpool has been endeavouring to find lead compounds free from the above objection. Before a compound can be employed for the treatment of human cases, it must fulfil the following conditions : (1) Be readily soluble in water or capable of forming an aqueous colloidal suspension which can be injected intravenously without the immediate precipitation of the lead as lead calcium phosphate in the blood-stream ; (2) the lead must be present in a non-ionizable form ; (3) pharmacological tests must show that the metal has no deleterious effects on the circulatory or respiratory system.

Compounds complying with these conditions were tested on rabbits inoculated with Brown-Pearce carcinoma. Out of 164 compounds examined, only three have been found suitable for use in the treatment of human cancer : they are (1) lead benzenesulphonyl glycinate ; (2) lead potassium 2 : 6-dithiol*iso*nicotinate ; (3) lead sodium o-thiolbenzoate.

Dr. Collier working in the Koch Institute, Berlin, has obtained some striking results with lead sodium o-thiolbenzoate and Professor Fournier, in Paris, claims outstanding properties for lead fumarate.

On the clinical side, Dr. Datnow has treated in the Walton Hospital, at Liverpool, cases of advanced cancer for whom no other treatment held out any hope, and has had outstanding success, using chiefly lead benzene sulphonyl glycinate and lead o-thiolbenzoate. Lead treatment has also been used for the prevention of recurrence in cases where only partial removal of the tumour has been possible.

The biochemical effects of radiations on normal and malignant cells was the subject of the Garton Prize Essay won by Dr. H. A. Colwell. Various hypotheses have been put forward as to the mode of action of

X-rays or the radiations from radium. The decomposition of lecithin has been regarded as explaining the destructive action of the radiations: other workers have held that the changes set up in the cholesterol contents of the cells were responsible: yet others have concentrated attention on some particular histological cell unit. Dr. Colwell thinks these views are inadequate: he considers that the mode of action is exceedingly complicated involving a disturbance of the physico-chemical equilibrium of the cell contents, of the oxidation phenomena, and of the inter-relations of cells due to the interference with the permeability of cell membranes.

At the Mount Vernon Hospital and Radium Institute, London, Professor Mottram has been studying the effect of gamma radiation on the nucleus of the cell. He had previously found that the nuclei of Jensen's rat sarcoma were greatly increased in size. This increase is confined to the nucleoplasm; the chromatin becomes diffused but remains normal in quantity. He considers that the irregularities in the division and migration of chromosomes during mitoses following radiation may be due to the increase in the nucleoplasm and not to direct action of radiation on the chromosomes.

His observations following on the radiation of the cells of bean roots have shown that after radiation the chromatin in the nucleolus is not passed on to the chromosomes, but accumulates in the nucleolus and finally overflows into the cytoplasm and gives rise to the cytoplasmic inclusions which have been observed. These nucleolar extrusions closely resemble some of the cell inclusions occurring in cancer cells which at one time were thought to be cancer parasites; and since nucleolar extrusions have been described by a number of observers in cancer cells, it seems likely that this may be their true nature.

One of the original aims of the Cancer Research Unit in Manchester was to find some practical means of preventing cancer as it occurs in mule spinners. The researches of the Unit have shown that among mineral oils the textile grades are usually more carcinogenic than the higher or lower viscosity grades obtained from the same crude oils. There appears to be some relation between carcinogenicity and the geological strata from which the crude oil is obtained. Also it appears that the more fully hydrogenated an oil the less likely it is to be carcinogenic.

By various chemical and physical processes oils can be rendered non-carcinogenic or, on the other hand, very highly carcinogenic. The Unit has investigated processes which would detoxicate the oils and which could be practical commercially, while at the same time leaving them suitable for lubrication purposes. Of the various attempts they have made in this direction it would appear that the best method is the sulphur dioxide treatment (Edeleanu process). Examination of extracts and residues from highly active oils has established the fact that apparently, no matter what the original carcinogenicity of the oil may have been, it can be rendered more or less harmless by sulphur dioxide treatment provided this is fairly drastic.

As regards preventive measures the Unit had previously shown the great benefit derived by mineral oil workers from the use of a mixture of anhydrous lanolin and olive oil. It has now been found that in the case of gas tar painted on animals treated with lanolin the skin of the animals remains smooth and healthy as compared with the scaliness of the tar animals not treated with lanolin. The tumour-bearing period in these experiments has not yet expired, so it is impossible to say whether the lanolin will prevent their development; it has certainly prevented the dermatitic activity of tar.

In determining the probable carcinogenic action of an oil, reliance is now placed mainly on its refractivity and the Unit suggests that spindle oil should conform to the following standard: "mule spindle mineral lubricating oils should have a refractivity below 5,520 when the specific gravity is above 895, or a refractivity below 5,500 when the specific gravity is below 895."

At the Westminster Hospital Mr. Stanford Cade and Dr. F. M. Allchin have been investigating the combination of X-ray and radium therapy. The advantages of the combined treatment are: (1) An appreciable increase in the total dosage administered is possible without any damage to the normal tissues; (2) the tumour can be irradiated through widely different parts of entry simultaneously; (3) tumours clinically resistant to radiation of one or the other wavelengths do at times become radio sensitive if submitted to both types of radiation; (4) the factor "time" can be prolonged.

Three groups of cases were submitted to the combined method of treatment: (*a*) Carcinoma of the pharynx; (*b*) sarcoma of bones; (*c*) skeletal metastasis following breast cancer. The combination of X-ray and radium treatment even in very high dosage was found perfectly safe. The percentage of good results was appreciably increased in all three groups of cases, but improved results have been most dramatic in the pharyngeal type.

In cases of cancer of the pyriform fossa, post-cricoid region, or extensive laryngeal growths the use of the bomb has been found to be essential and treatment without it was impossible as shown by persistent failure to relieve the patient until mass radiation was adopted.

Cancer of the breast in *young women* (under 40 years of age) and cancer in a lactating breast is so virulent and rapidly fatal that surgery has proved of little value in its treatment. In such cases Radium in massive doses is considered the first line of treatment. To give adequate radiation both needling and external radiation must be used.

The best results from surgery are stated to be obtained in women over 50 years of age with early cancer and no enlargement of the axillary glands. In such cases radium takes second place. In post-operative recurrences radiation presents the only hope for the patient. Mass radiation is useful in selected cases, but the majority of breast cancer cases can be treated with needles and plaques either alone or supplemented by modified conservative operative treatment.

Clinical and other Notes.

BACILLUS PYOCYANEUS AND SYSTEMIC INFECTION.

By Captain S. S. BHATNAGAR,
Indian Medical Service.

The idea that the *Bacillus pyocyaneus* is a harmless curiosity was disproved by Ledderhose [1] and Charrin [2], who clearly demonstrated its pathogenic properties. Its clinical and pathological manifestations in man have been reported by various observers (Wilson [3], Schneider [4], Sonnenschein [5], Shrewsbury [6], etc.). In 1896 Williams and Cameron [7] noted that *B. pyocyaneus* sometimes enters the blood-stream and gives rise to a generalized infection. Pons [8], while studying the ætiology of melioidosis in Cochin-China, made an important observation on the special pathogenicity of *B. pyocyaneus* in the tropics and its responsibility for an infection which closely simulates those enteric in origin.

As it is generally believed that *B. pyocyaneus* is either a secondary invader in various suppurating conditions or affects debilitated individuals and children primarily, a record of four cases of systemic infection by this organism in young healthy individuals, studied from the clinical and bacteriological points of view, may be of some interest.

In three of these cases the infection was purely accidental, due to hypodermic inoculation of novocain solution contaminated with *B. pyocyaneus*. In Case 1 the contaminated solution was injected over the lumbar region to anæsthetize the skin as a preliminary to intraspinal anæsthesia. Here it resulted in cerebrospinal meningitis with a fatal termination. In Case 3 local anæsthesia was produced over the right hypochrondrium with a view to an operation for inguinal hernia under avertin anæsthesia. In Case 4 the contaminated solution was used to remove a thorn from the back. In Case 2 the source of infection is not certain, but in all probability the infection took place through the ingestion of virulent strains of *B. pyocyaneus* by the mouth. The resulting infection in Cases 2, 3 and 4, closely simulated one enteric in origin.

Case 1.—A young healthy individual of about 40 years of age was operated upon for the removal of a semilunar cartilage from the right knee-joint under intraspinal anæsthesia. The skin round about the site of lumbar puncture was at first infiltrated with a 2 per cent solution of novocain prepared in the dispensary of the hospital and stocked in the operation theatre for five days before use. An ampoule of stovaine solution, purchased locally, was then injected intraspinally. The patient died on the seventh day after operation.

First day: Cartilage of right knee removed under spinal anæsthesia.

Aspirin, ten grains, given at 11 a.m. Was fairly comfortable, but did not pass urine after eighteen hours.

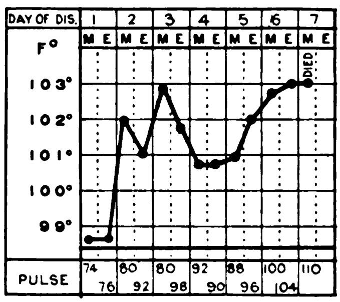
Second day: Had a bad night, complained of severe headache, frontal and occipital. Mist. bromide, one ounce at 10 p.m., had no effect. Morphia ¼ grain given hypodermically at 1 a.m. Slept at intervals, vomited several times.

Slept all afternoon; catheter passed, urine, twenty-five ounces, drawn off; headache still severe, ice bag applied.

Third day: Headache very severe, morphia ¼ grain 9.30 p.m., slept at intervals. Complained of nausea and vomited twice. Felt better in the morning. Condition during the day unchanged, perspired slightly.

Fourth day: Had a poor night, headache and nausea continued, vomited several times. Complained of double vision in the afternoon.

Fifth day: Comfortable night, slept at intervals, dull ache in head, slight cough and wheezing of chest. Sight normal this morning, no vomiting.



Case No. 1

Fairly comfortable afternoon but not so well this evening. Rambling and inclined to be restless. Pupils slightly dilated. Bronchopneumonic patches in both lungs. Slightly cyanosed.

Sixth day: Delirious all night, retraction of head, pupils dilated, restless and picking of bed clothes. Had hiccough all night. Condition critical.

Condition unchanged; unsuccessful attempt at lumbar puncture; incontinence of urine and fæces. Blood slide showed no malarial parasites. Slight expectoration and hiccough.

Seventh day: Condition unchanged; catheterized; pulse very weak; breathing difficult about 3.30 a.m. Died 4.45 a.m.

Post-mortem Appearances.—The chief findings were in the central nervous system and the lungs.

Thick sticky yellowish-white pus covered the convolutions of the brain in places, looking more like a slough than actual pus. A thick layer was present on the undersurface of the cerebellum. The brain substance was soft but there were no hæmorrhages and no localized collection of pus. The cerebrospinal fluid was thick and sero-sanguineous in appearance.

Both lungs were dark in appearance owing to deep congestion. Three bronchopneumonic patches, one in the right upper lobe, and one in the right middle lobe, and one in the upper left lobe near the apex, were discovered.

Bacteriological Findings on the Organism Isolated from the Cerebellar Pus.

Morphology: Rods, $1 \cdot 5 - 2 \cdot 0 \times 0 \cdot 3\ \mu$ actively motile, Gram-negative, non-capsulated, non-sporing, non-acid fast; single, in pairs, or in short chains. Those isolated from the intraperitoneal fluid of a guinea-pig, after intraperitoneal injection, were in long chains.

Agar Slope: Luxuriant growth after six hours incubation at 37° C., slightly raised with an undulating edge, translucent, medium green after twelve hours. As a rule after five days the growth became clear and hardly visible.

Agar Plate: Moist, round, slightly convex colonies with a glistening surface and yellowish green hue; easily emulsifiable, medium tinged green.

Gelatin Stab: Rapid crateriform liquefaction, thick growth at the bottom of the stab; liquefied portion yellowish green.

Broth: After twelve hours at 37° C., abundant growth at the top of the medium in the form of a thick white ring with a thin surface pellicle. The upper portion of the medium is green, the rest of the medium is hazy. On the second day there was a thin white sediment, disintegrating on shaking; the whole of the medium was still green.

Biochemical Reaction: Glucose acid, no gas on the fourth day; lactose, mannite, dulcite and saccharose were unchanged. Indol was not produced.

Methyl red reaction was negative.

Voges-Proskauer reaction was positive.

Resistance: Only one colony was found after half an hour at 55° C.; no growth after one hour at 55° C.

Abundant growth occurred on the usual laboratory media; optimum temperature 30-37° C.; grew both aerobically and anaerobically, but very little pigment was produced under anaerobic conditions.

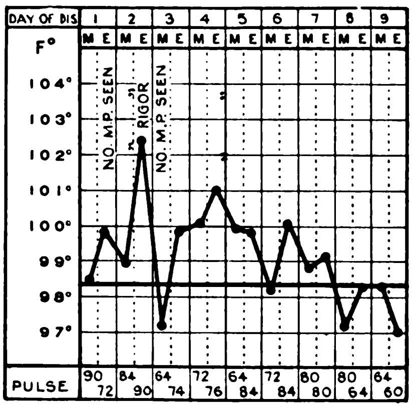
It was a highly virulent organism killing guinea-pigs, when injected intraperitoneally, intrapleurally and intracardially within six hours; one guinea-pig injected subcutaneously died in thirty-six hours. Rabbits injected intraperitoneally and intrapleurally succumbed within eight hours. One guinea-pig injected subcutaneously developed an abscess at the site of inoculation on the third day but survived. Post-mortem examination of this animal showed an excessive amount of sero-sanguineous fluid in both the pleural and peritoneal cavities; deep congestion, petechial hæmorrhages and softening of the liver, lungs, heart, spleen and the suprarenals; areas of focal necrosis most marked in the lungs then liver, heart and spleen. Except for congestion nothing abnormal was noted in the brain.

B. pyocyaneus was isolated from the intrapleural and intraperitoneal fluids and from the heart's blood.

These findings were confirmed at the District Laboratory, Quetta, and the Enteric Laboratory, Kasauli.

Case 2.—Young healthy soldier, aged 25, fainted in the ablution room and was admitted to hospital with severe headache, pains in the neck and back, tongue coated, spleen not palpable but the splenic area slightly tender, temperature 98° F., pulse 90. Moderately severe generalized headache lasted for two days. The pain in the neck, back and lumbar region disappeared on the seventh day. The pulse was dicrotic on the sixth and seventh days.

Blood examination revealed no malarial parasites. Differential count showed polymorphs 65 per cent, lymphocytes 23 per cent, large mononuclears 8 per cent, eosinophils 4 per cent.



Case No. 2

WIDAL REACTIONS.

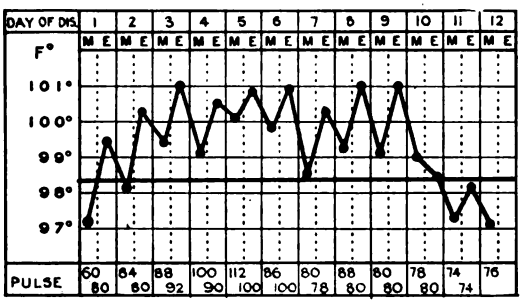
		4th day	7th day	11th day	15th day
T	..	16	16	22	17
A	..	12	12	12	13
B	..	25	25	25	24

A blood-culture taken on the fourth day of disease gave a luxurious growth of actively motile Gram-negative organisms which were later identified as *B. pyocyaneus*. This diagnosis was confirmed at the Enteric Laboratory, Kasauli. The same organism was isolated from subsequent blood-cultures till the eighth day of disease. The blood-culture on the ninth day of disease was sterile. This coincided with the last fall of temperature. Several attempts were made to isolate the organism from the urine and fæces, but with no success. It is of interest to emphasize that the cyanobacteriæmia lasted till the temperature touched normal for the last time when there was a quick disappearance of the organism from the blood

stream. The highest titre of agglutination of patient's serum against homologous organisms was 1 : 50 on the twelfth day of disease. This indicates that there is some attempt at antibody formation. This titre was not obtained in the earlier agglutination tests.

A point of great interest is the difference in the pathogenicity of this organism compared to that of Case No. 1. Rabbits and guinea-pigs were injected subcutaneously, intraperitoneally and intravenously. There was a rise of temperature of from 3°-5° F., but no death or any abscess formation. The rise in temperature lasted for five days.

Case 3.—Young, healthy soldier, aged 25, was operated upon for inguinal hernia under avertin per rectum and novocain locally. On the second day after the operation the patient started running a temperature which continued for ten days with one remission on the seventh day. The highest temperature was 101° F.



Case No. 3.

There was no leucocytosis. The area of operation was clean and healthy throughout and healed in the normal course. The Widal reactions were negative. But from the first blood-culture, on the fourth day of the rise in temperature, a Gram-negative actively motile organism was isolated which proved to be *B. pyocyaneus* and identical with that isolated from Case 1 in its morphological and biochemical reactions, but totally different in its pathogenicity. The rabbits and guinea-pigs injected with it showed only a rise in temperature, but no death or any abscess formation.

Case 4.—A healthy adult, aged 42, reported to his medical officer for removal of a thorn from his back. The skin round the thorn was anæsthetized by the same novocain solution used in Cases 1 and 3. The patient reported sick the next day with high temperature and general malaise. The fever lasted for five days. The area round the site of infection was red and inflamed and remained so for over a week. Unfortunately no blood-culture could be done on this case as he left the station soon after the removal of the thorn and reported sick at another

station where he had gone for a holiday. A blood-culture taken on his return was sterile. But from the local condition where the novocain solution was injected and the history of fever, details of which were obtained from the other station, there was no doubt that this case belonged to the same category as Cases 1, 2 and 3.

SOURCE OF INFECTION.

It was possible to recognize and investigate these cases with ease because one fatal occurrence had drawn the attention of every medical officer in the station to them and the co-operation between the various departments was at its best.

The novocain solution, the stovaine solution ampoule, the novocain powder and the distilled water, used in preparing the above novocain solution, were examined bacteriologically. A Gram-negative, actively motile bacillus, eventually proved to be *B. pyocyaneus*, was isolated from :—

(1) The novocain solution.

(2) The distilled water used in preparing the above novocain solution, but the ampoule of stovaine solution and the novocain powder (a solution of which was prepared with the distilled water of the laboratory) were sterile.

The pathogenicity of the organism isolated from the three different sources, namely, the cerebellar pus, the novocain solution and the distilled water, was determined by injecting four sets of guinea-pigs and rabbits, subcutaneously, intrapleurally, intraperitoneally and intracardially. The organism was found to be very virulent in every case.

From these observations it was concluded that the source of contamination was the distilled water.

Water was distilled in the dermatological department and supplied to every other department. With a view to determine how and where the water became contaminated the following investigations were carried out :—

(1) Water was collected for bacteriological examination from the taps supplying the dermatological department. It was found to be free from *B. pyocyaneus*.

(2) Washings were obtained from the various parts of the distilling apparatus and examined bacteriologically. No *B. pyocyaneus* was isolated.

(3) Samples were taken from the water immediately after distillation and from the one stored in the dermatological department. Both were free from *B. pyocyaneus*.

(4) Samples were taken from the distilled water supplied by the dermatological department to the dispensary. It was found that the sample taken immediately after the issue was free from contamination. But the samples taken from the same water on the second and third days were both contaminated and *B. pyocyaneus* was isolated. When injected

into a guinea-pig this strain was found to be pathogenic, killing the guinea-pig within twenty-four hours.

This lead to the conclusion that the contamination of water took place in the dispensary.

Agar plates were next exposed in the dermatological department, the dispensary, the operation theatre, the surgical ward and the surgical dressing-room. *B. pyocyaneus* was isolated from the plates exposed in the dispensary but not from those in any other place. This result shows definitely that the organism *B. pyocyaneus* was present in the atmosphere of the dispensary and the infection of the novocain solution took place there through the water used for preparing the solution.

It is of great interest to note that formerly the novocain solution was usually boiled before use. But as, on the last occasion when it was boiled, it did not act well as a local anæsthetic, the solution used in infiltrating the skin of Cases 1, 3 and 4 was not boiled before use and had been stocked in the operation theatre for five days.

SUMMARY.

(1) An account of four cases of systemic infection with *B. pyocyaneus* is given.

(2) All the cases occurred in young individuals in the best of physical condition. This is in contrast to the view generally held that *B. pyocyaneus*, as a primary invader, attacks either debilitated adults or children.

(3) *B. pyocyaneus* gives rise to an enteric type of infection which can only be diagnosed by blood-culture. If a blood-culture is not made the systemic infection is liable to be overlooked and diagnosed as "Pyrexia of unknown origin (P.U.O.)" or "Enteric group infection."

(4) One case demonstrated the entry of *B. pyocyaneus* through the meninges, the blood-stream, and the alimentary track into the system, and affords an excellent example of the virulence of an organism being increased by passage through the meninges.

(5) The advisability of strict surgical asepsis when using novocain solution as a local anæsthetic is indicated. The solution should either be freshly prepared or boiled before use even though it then deteriorates in its anæsthetic value to a certain degree.

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Echoes of the Past.

BURMA 1885-1887. CHITRAL 1895. ASHANTI 1896.

By Lieutenant-Colonel G. A. KEMPTHORNE, (R.P.) D.S.O.,
Royal Army Medical Corps.

In previous numbers of the Journal[1] an attempt was made to summarize the chief events of medical interest in Egypt and the Soudan from the commencement of Sir Garnet Wolseley's campaign in 1882 to the occupation of Khartoum by Sir Herbert Kitchener in September, 1898. During parts of this period British troops were engaged in the pacification of Burma, and on the Indian Frontier, and the Gold Coast.

The Third Burmese War.

The acquisition of the Province of Burma by the British was the outcome of three wars. In 1826, on the conclusion of the First Burma War, Tenasserim and Aracan were annexed, in 1852 Pegu was added. The war which commenced in 1883 ended in the inclusion of Upper Burma and the Shan States in the British Empire.

For several years our relations with the Court of Ava had been strained. Disgusted with King Thibaw's cold-blooded massacres of his relatives, we withdrew our envoy in 1879. An oppressive fine levied on the Bombay and Burma Trading Corporation in the summer of 1885 and the report that the King was intriguing with the French, brought things to a climax, when the occupation of Mandalay and the deposition of Thibaw was seen to be inevitable.

At this time these were about 850 miles of road in the British Province of Lower Burma, and Rangoon was connected with Prome and Tourgoo by two separate lines of railway, but the chief means of internal communication were the great waterways, the Irrawaddy and its tributaries. The vessels of the Irrawaddy Flotilla Company plied regularly as far as Mandalay. Little was known of Upper Burma except that dense jungles traversed by roads which were no more than lines more or less cleared of jungle growth, hills and forests, where the bridle paths necessitated single file, alluvial areas under crops almost all the year, and sandy waterless tracts, would be likely to prove most embarrassing for regular military operations. And so it turned out.

In November, 1885, a force of 9,034 men, one-third of them Europeans, including the King's Liverpool, Royal Welch, Hampshire, 6 native infantry regiments, of which 4 were Madrassis, a pioneer regiment, and 67 guns,

[1] Journal of the Royal Army Medical Corps, 1928.

assembled under Major-General H. N. D. Prendergast, V.C., round the frontier post of Thayetmo. There were 2,810 followers, among which were numbered 900 Kahars under a R.E. officer and three transport conductors with 200 dandies. These were distributed between the General Hospital, the Field Hospital and the Regimental Units. The P.M.O. of the force was Deputy Surgeon-General J. M. Donnelly, I.M.S., who had as his staff officer Surgeon-Major H. W. A. Mackinnon, of the British Medical Service. A base hospital was built at Rangoon, and British and Indian General Hospitals of 200 and 475 beds respectively under Surgeon-Majors J. N. Stock and J. W. Johnston, each with 6 medical officers, were established at Thayetmo.

The line of the advance was by river, and the troops were embarked on 55 shallow draft vessels to which flats were lashed, supplied by the Irrawaddy Flotilla Company. Naval gunboats accompanied them. Three ships, the "Rangoon," "Penlang" and "Waikema," each with two double-decked flats, and admirably suited for the purpose, were allotted for the reception of casualties and for the medical units. Each flat took 70 patients. In the "Rangoon," which was described as a floating hospital, were No. 4 B.F.H. (Surgeon-Major E. Townsend[1] and 4 officers), and 2 sections of No. 5 B.F.H. (Surgeon-Major R. Corbett), with a N.F.H. and 2 sections of another (Surgeon-Major J. Makenna, I.M.S.). The two remaining sections of No. 5 B.F.H. and No. 14 N.F.H. (Surgeon-Major Peters, I.M.S., and 4 officers) being allotted to the other two ships. These latter were classed as travelling hospitals, it being assumed they would be used for evacuation. A third B.F.H. (Surgeon-Major J. A. Howell) was employed at the base. Each Regimental Unit had a medical officer.

The distance to be covered was about 300 miles, and the time taken after crossing the frontier was fourteen days. There were numerous fortified positions along the river bank, some of which were evacuated by their garrisons after a few shells from the naval flotilla, and others were turned by landing parties of troops, who at times had to make a considerable detour through the jungle. Except at Minhla, where three Madrassi regiments showed lamentable lack of enterprise in spite of their officers' efforts, resistance was negligible. Colonel J. M. Beamish, who was one of the staff of No. 4 B.F.H., has described in the Journal their departure from Rangoon on November 15. Passing Prome and Thayetmo, they reached Minhla on the 16th, where they came in just after the engagement. The medical officers landed, and three killed and twenty-six wounded were collected by lamplight.[2] On the approach to the capital the King gave in, and formally surrendered on November 28. During the fortnight, 4 British officers, 7 British other ranks, and 10 Indian other ranks were killed, among

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[1] Sir E. T. Townsend, K.C.B., P.M.O., 1st Division in the Tirah Campaign, and in the South African War.

[2] Journal of the Royal Army Medical Corps, vol. xxi.

them Surgeon J. Heath, A.M.S., who, with two other officers, was ambushed at Sagaing. He was mortally wounded when in the act of carrying one of his wounded companions.

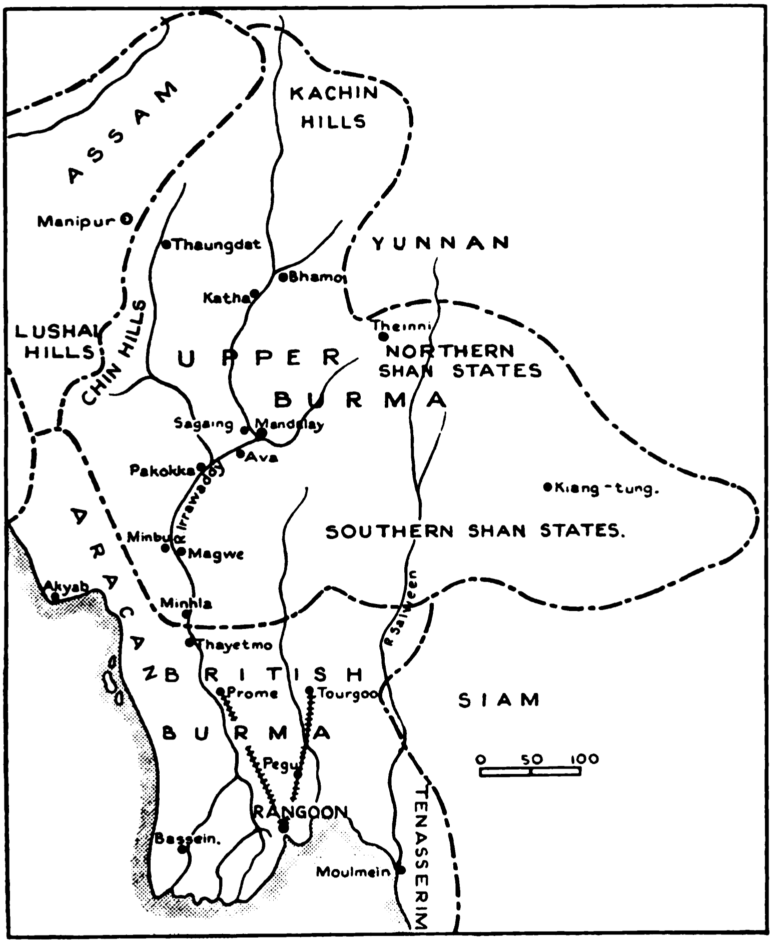
After the occupation of Mandalay, the field hospitals were opened in buildings and a temporary officers' hospital was formed. There was a small outbreak of cholera during December and January, with 154 deaths, but otherwise the men remained reasonably healthy. Meanwhile, Bhamo was occupied, a hospital ship accompanying the troops who were conveyed by river.

Unfortunately the Government were unable for some time to make up their minds over the disposal of the conquered territory, and, by the New Year, when the formal annexation took place, Upper Burma was already overrun by Thibaw's disbanded soldiers, who, with the connivance of rival chiefs and secure in the impenetrable cover of their jungles, raided in all directions. The British and Indian regiments were broken up into detachments and small columns were constantly on the march, but with little success. Sick transport with these columns, except where water carriage was used, was at first entirely by hand. Later, by scouring the country, some ponies and elephants were brought in. In March, when Sir Harry Prendergast handed over command to General George White, the P.M.O. returned to Rangoon, and for the next six months his representative in the field was Surgeon-Major Mackinnon, an officer of energy and tact, whose merits were perhaps inadequately rewarded in the distribution of honours.

All known and feasible precautions seem to have been taken for the welfare of the troops. They were well fed, and good barrack huts were built, raised above the ground on bamboo platforms, but, with the increasing heat and the rains, the sick list, which hitherto, except for venereal disease, had been a low one, began to go up. Enteric fever caused a certain mortality, but most of the sickness was ascribed to malaria, dysentery and hepatitis. In August, a quarter of the garrison of Bhamo was in hospital. Between April 1 and June 30, during which period contact with the enemy occurred 72 times in various places, 71 men were killed, 206 wounded, 269 died of disease, and 959 were invalided. The record for the first twelve months, in a highest strength of 14,000, was killed 91, died 930, invalided 2,032.

In November, Sir Frederick Roberts, then Commander-in-Chief in India, arrived at Rangoon, and large reinforcements were already on the way, including cavalry and mounted infantry, in which the original force was entirely deficient. Surgeon-General George Farrell of the Bengal Medical Department was sent out as P.M.O. of the Field Force. He found he had to provide for an army which, including the newly-recruited Burma police, numbered some 32,000. This was distributed between 70 to 80 posts, with garrisons varying from 50 to 3,000 men, in an area about the size of France. Medical attention had also to be found for flying columns and 700 miles of river. The correspondent of the *Lancet* described the

sickness and mortality at this time as terrible, but expressed his satisfaction with the arrangements made for the Medical Services. One of the first undertakings of the new P.M.O. was the reorganization of the Bearer Corps. At his request, he was allowed to take over the entire strength of the bearers in the country and the materiel, which consisted, for the most part, of Lushai dandies. He also became responsible for the clothing,



feeding, payment, and forwarding of the family remittances of the personnel. An ambulance officer was appointed and a school of instruction formed. Here, probably for the first time, the whole question of the relation of the bearer to his load was scientifically worked out. The Lushai dandy weighed normally 60 lbs. and a quarter as much again when soaked with rain. The team allotted was four men, but, under local conditions, two for reliefs were found to be essential. The race of Kahars, with their finely-developed deltoid muscles, was already nearing extinction. In 1865, Sir William

Mansfield, the Commander-in-Chief, had urged that this useful caste should be specially nurtured and supported by Government as being essential to the Army's needs, but without result. The greater part of the bearers sent to Burma were coolies; a particularly low type of these men was imported from the Coromandel coast. However, under careful training, something was made of them. An attempt was also made to utilize 10 lb. stretchers with Burmese bearers. A corps was formed, but was a complete failure.[1]

The principles adopted in dealing with the dacoits involved the sending out of parties from already established posts, and the maintenance of communication with intermediate posts by constant and systematic patrols. In this the Mounted Infantry played an important rôle. When the Commander-in-Chief returned to India in February he was able to report real progress made, which was maintained through the year. The battle honour, Burma 1885-1887, borne by ten British infantry regiments, covers the period up to April 30, 1887, by which date most of the important gangs were broken up, but it took another four years of police work to restore anything like order. R.A.M.C. officers accompanied the Chin-Lushai expedition on the Assam border in 1889-1890, where the gallantry of Surgeon F. S. Le Quesne was rewarded by the bestowal of the Victoria Cross. Another officer, Surgeon-Major E. P. Lloyd, acquired the same distinction during an attack on the British post of Sima in the Kachin country in January, 1893.

It may be mentioned that owing to the large number of convalescents who accumulated in Madras during the war, it was decided to send them on sea trips in the Bay of Bengal. The hospital ship, "Tenasserim" made several voyages, it is said, with good results. Surgeon-Generals Farrell and Donnelly received the C.B. for this campaign and Surgeon-Major Mackinnon the D.S.O.

(*To be continued.*)

[1] Vide Longmore's "Manual of Ambulance Transport," edited by Surgeon Captain W. A. Morris, 1893. An invaluable work of reference.

Travel.

THREE MONTHS IN KASHMIR VALLEY.

By "UNST."

(*Continued from p.* 274.)

We resumed our climb, attaining the crest of the ridge and working along it, amidst great drifts of old snow, in an unsuitable locality, I imagined, for the birds. I suggested this to the shikari, who agreed, and then my attention was suddenly drawn to the second shikari, who appeared to be having some sort of a fit further back. The object of his convulsive activity, now concentrated into one agonized attempt to point, was a very large black bear, some two hundred and fifty yards away, and well beneath us, moving unconcernedly, but at a fair pace. I took my rifle from the shikari, and, sitting down to the shot, took careful aim, drawing a bead on the animal's neck. I pulled the trigger, and he gave tongue loudly and characteristically, half rearing on his hind legs. I was sure I had killed him, and succumbed to my usual fault, not getting in my second shot, a habit which, unless cured, may one day react unfavourably upon myself. The bear, instead of collapsing as I expected, fell again on all fours and made off. I got in another shot as he was moving, an obvious miss, and he disappeared behind a large rock, getting into dead ground, giving tongue continuously, and reappearing well out of range, turning the shoulder of the hill. We rushed to the spot where we had first seen him, and found copious blood tracks, mingled further on, with shattered fragments of bone, which disheartened the shikari, who was convinced that the animal had merely sustained a smashed shoulder, and would go for miles. With no great confidence, we commenced to follow up. As we progressed, the blood became more and more copious, and the tracks led straight downhill, good signs both, although the ground over which we were taken was of the most appalling character, steep, covered with loose, weed-riddled soil, which peeled off under the feet, and tangled with thick undergrowth. The blood grew less and then dried up completely, the tracks being more difficult to follow, and on several occasions we were compelled to cast about to find them. Fortunately the ground was mostly soft, and, except for one long interval, when I nearly gave up hope, the tracks were lost for no great period of time. About a mile further on, the blood reappeared, in larger quantities than formerly, and the tracks, leading out on to a spur that dipped into a deep nullah, terminated at the mouth of a narrow cave, difficult of access. To approach this cave a little rock climbing was necessary. To get above the entrance, we had first to go beneath it, and cross a little platform just in front of the mouth of the cave. The shikaris went up first, while I stood guard with the rifle, and then ascended myself, first

passing up my shot gun, loaded with lethal, to the shikari, who covered the mouth of the cave. Thus we were taking all possible precautions, but I cannot help thinking that the bear, if he had chosen to emerge at that moment, would have been presented with a complete cockshy, because no rifle bullet ever moulded will stop a charging bear within two yards, and the very impact of his body, dead or alive, would have precipitated one or all of us into the nullah beneath. He was in the cave, there was no doubt about it, for the tracks, having entered, did not emerge, and the walls and roof were puddled with blood. We reached the rocks above the cave without mishap, and the shikari ventured out on to a tongue of rock leading into the roof of the cave, to obtain a better view of the interior. He came back and I took his place, noticing that, far back in the cave, there was a vertical slab of rock forming an incomplete partition, dividing the cavity about equally. Behind this rock the bear might be, unless his abode led into the hillside, and he had gone still further back.

I returned, and the shikari, securing a firm foothold at a point above and a little in front of the mouth of the cave, thrust a long stick, which he had cut from an adjacent tree, as nearly as possible against the slab of stone, scraping the walls and roof, producing a hideous noise like muffled thunder. This produced the desired effect, With a series of deep, growling "hough's" the bear charged out, turning towards the shikari, who was well out of reach of a direct attack, and offering me a splendid target, which I missed completely.

To my dying day I shall never understand how I missed that shot. The bear was right underneath me, at a distance of about six feet, and, reconstructing the scene, I look upon it as one of the worst errors I have ever committed. There was very little element of intense excitement, as the shikari and myself were both out of immediate danger, I was fit and rested, suffering none of the agitation experienced after a long, hard stalk, and the bear, in his effort to attack the shikari, had slowed up almost to a halt, so that it was not a case of a snapshot at a flying target. Anyhow, I missed it, and the bear, wheeling away from his intended victim, made off at a tangent downhill, and we followed circumspectly. I had my work cut out to prevent the shikari from losing his head, as he was so apt to do, and indulging in a precipitous flight after the bear, leaving me struggling in the rear.

We walked cautiously through dense, low jungle, eventually emerging, after an exhausting stalk, in a level clearing. Here the shikari grabbed my arm, and I swung round, expecting a charge, but he was pointing to the skies. I followed the direction of his upflung finger—the bear was up a tree, not ten yards from us, not thirty feet above our heads, standing on a thick horizontal branch, which he was grasping with all four paws. In another moment I should have passed right underneath him, giving him the opportunity for which he was doubtless waiting. I raised my rifle, sighted quickly, and fired, knocking him out of the tree.

I had hit him this time, as I discovered later, seriously, the bullet passing through his chest, but far back, so that life was still in him, and he passed slowly in front of us, forgetting everything, his enemies, any intention of escape, and clinging, with his last vestige of consciousness, to his ebbing life, his great spirit still, *in extremis*, holding his mighty body erect. As he tottered, sinking, I shot him through the neck, and killed him.

He was an extraordinarily big beast, old and bulky, measuring between pegs five feet and eight inches. We bore him, magnificent even in death, across a foaming stream to a village near at hand, where the shikaris set to work with their skinning knives, and his hide and skull were despatched to the Plains in the South, to be preserved and set up as a trophy, casting over me, here in an English winter, memories of the mountains and valleys of past days.

The chase had carried us some thousands of feet below camp, and several miles from it. The weather had changed, snow falling heavily, while the shikaris and villagers predicted storms. Seated on a charpoy (string-bed) on the verandah of the village headman's house, eating walnuts and drinking boiled milk, the only meal available (the monal was yet too fresh), I looked across the valley, now blotted out with whirling snowflakes, thought of my far-off camp, and decided that in this case the mountain must come to Mahomet. I gave orders that, when the weather abated, coolies should be sent to fetch my tents and baggage, and that my camp should be pitched afresh at a spot further down the stream, well away from the village, none too sanitary, where I was at present staying.

One examining the bearskin, I found that my first shot had entered the bear's chest through the neck and shoulder. This should have been vital, but the enormous cushion of muscle and fat, reinforced by bone, had impeded the penetration of the bullet to such an extent as to render the wound practically superficial. The second bullet had passed through the lungs, far back, and the third through the neck at the base of the skull.

I slept that night near the village, outside, under a rough shelter, on a charpoy, fearful of fleas, but encountering worse horrors in the form of bed-bugs.

Late the following morning, tents were pitched where the valley narrowed between steep cliffs. Leaving the village I saw to the disposition of the new camp, and, accompanied by two shikaris and a tiffin coolie, climbed up a steep side nullah in search of pheasant. We had not gone two hundred yards, when, like jack-in-the-boxes disappearing, the shikaris hid, and I followed their example, aware of nothing, but obedient to their sharper senses. I looked all around, seeing nothing, but I could hear from the other side of the nullah a "crack-crack-cracking-sound," which I had not heard before, made by a black bear cracking a mouthful of walnuts, a favourite article of food when available. I was unaware of what was happening until, from a bush, fifty yards away, the bear emerged, and I shot him through the neck, wondering, as he fell into the bed of the nullah, if this were really sport.

He was a smallish male with a very good coat and a large amount of fat, which, along with the hide and skull, the shikaris removed, and we returned to camp, after about twenty minutes of an outing, to the intense delight of my bearer, whose idea of a successful day's shikar was a maximum bag with the minimum of effort.

Snow fell that night and I allowed myself a half-bottle of Burgundy. In the morning, during a very steep walk over new, soft, slippery snow, I got "pounded," and was forced to undertake a sitting glissade of about two hundred feet to extricate myself. We saw no birds, but later in the day, higher in the hills, we came across the tracks of bear. These we followed for hours, over steep ground rendered tricky by new snow, over which, on more than one occasion, I did involuntary glissades. Terminating one of these excursions against the stump of a dead tree, which deluged me with a shower of rotten wood, I noticed the shikari, some distance above me, performing the unpleasant epileptiform evolutions invariably induced in him by the proximity of game, so I cautiously retraced my steps. He was hiding behind a tree, pointing to a great pine about thirty yards away. I noticed there seemed to be something wrong with the tree's roots, which thrust, like the spread fingers of a gnarled hand, wide into the snow. Behind the largest of these roots, in the angle between it and the tree, was a rounded black hump, covered, as I could see through my telescope, with fur, which trembled in the slight breeze. This was the bear, sleeping, feeding or resting. I shot him, and with one terrific howl, it leapt into the air and rolled, dying, down the hill, caught up in a bush some twenty yards below—a female, with well-worn teeth and very little fat, a fact lamented by the shikari, who judged the worth of a bear by the amount of subcutaneous fat it carried. Death must have been instantaneous, the bullet passing through both kidneys.

Bad weather and a plague of monkeys, who raided the camp at the slightest opportunity, made me long for lower levels, so I sent for coolies, and shifted camp, choosing a rest-house not far from the Wular Lake, where I could shoot chikor. To occupy the resthouse it was necessary to obtain permission from the forest-officer, who was a Hindu, and who completely overwhelmed me with his more than Oriental politeness and his intense delight at my arrival. There was reason enough for this, I learnt later, for at the time trouble was brewing at Kashmir, trouble of a communal variety that was to bring persecution to the few scattered Hindus in the State. I heard later that my friend the forest officer, shortly after my departure, had fled the neighbourhood, not before receiving a few gentle hints in the way of assault and arson.

The rest-house was old and bleak, so I used it chiefly as a store, and stayed in my tent. Every day we searched the neighbouring hills for chikor, which, walked up or driven, provide magnificent sport. However experienced the sportsman may be, he will find in well-driven chikor, helped preferably by the wind, a worthy mark. I employed the following

methods: before sunrise we were in position, several hundred feet up the hillside, for the birds, at this time, descend from the summits of the lower hills to feed and water. We cast round until a covey was seen, and then, after I had changed position or not, according to circumstances, the shikari and a line of beaters would attempt to drive the birds over. Shot birds retrieved, and the remainder of the covey marked, the beaters carried on until they reached me, and then I proceeded, straight, or by a circuitous route, cautiously to a point beyond the birds, while the beaters remained at my first stand. When I had taken up position, the beaters closed and again drove the birds over. In this way much better sport is afforded than by walking up, as a walked-up chikor, flushed from anywhere near at hand, gives no very sporting shot, although, truly, walking up over country of any difficulty teaches the sportsman one of the first maxims of hill-shooting, namely: let your feet look after themselves and keep your eyes on the surrounding country, not on the toes of your boots.

Just at sunset, the birds leave their feeding grounds and return up the hills to rest for the night. At this time, whole coveys are frequently seen running uphill in a most determined manner, and when this happens, you may reach for your dummy cartridges and call it a day.

The best chikor ground is hilly country, where, low on the hillside, shade, vegetation and running water are found, and where the summits are wooded or covered with shrub, to afford the birds shelter for the night.

Birds were not over plentiful; I shot fairly well and sport was excellent, my biggest bag for one day being eleven and a half brace.

Late one afternoon, when birds were few, I climbed to a rocky height above the valley, and was rewarded by a magnificent view of the Wular Lake, blue as a sapphire, framed in cloud, and mirroring in its quiet waters the untroubled snows. Loud skeins of wild geese, flighting in from the great jheels of Hokra and Haigam, swept majestically across the sky, and large flights of ducks wheeled and curvetted, crossed and re-crossed, dipped and rose, calling up memories of many happy days spent with dog and gun.

That night I composed a letter to my agent in Srinagar, asking for a houseboat to meet me at Sodinara, on the Jhelum river, a spot several miles from my camp. My shikari, hearing of my intentions, organized a duck shoot for me next day, and, in spite of the sketchiness of the preparations, it was highly successful. Tramping through the rain to the shores of the Wular Lake, we constructed a makeshift hide of vertical branches laced together, and filled in with twigs and straw, where I spent the entire day, accounting for eighteen mallard. In this locality, although I arrived well after the morning flight and did not wait till evening, duck were continuously on the move, mallard chiefly, although I saw pintail and gadwall as well. Next day, shooting from nearer the water, the bag was smaller, but more varied, including teal, gadwall, mallard, widgeon, pintail and one snipe that I flushed on leaving my hide to retrieve a drake mallard.

On returning to camp in the evening, I received from the dak coolie a

telegram, stating that my boat was due in Sodinara next day, so, not without regrets, I paid off the majority of my staff, providing them with the usual "chits," bakhsheesh and a few photographs, and turned in for the night. In the morning, having collected pack transport, I set off in a downpour to Sodinara, crossing the shoulder of a hill by a footpath which joined the Bandipore-Srinagar road and tramping through a flooded countryside, passing the shikari's village on the way, and stalking a jheel inhabited by myriads of teal, out of which as they rose I bagged a lucky right and left.

At Sodinara, reached in the afternoon, I was met on the banks of the river by the "manji" who led me to his houseboat, which I entered, kicking off wet and dirty boots. The houseboat was a palatial vessel, consisting of a dining room, a sitting room, a porch, two bedrooms, a bathroom, and, attached, another and smaller boat, which served as a cookhouse, where the "manji" kept his numerous family, including his eldest son, who was an efficient small game shikari, and proved his worth during the following month. In addition, I had at my disposal a small canoe or "shikara," innocent of any canopy, such as may be seen on the waters nearer Srinagar, but providing a most efficient form of transport on the river. Having settled into my new environment, I paid off my shikari, who had shown me such excellent sport, and we parted on good terms, although I was rather aggrieved by the insistent manner in which he endeavoured to squeeze the very last possible anna out of me, producing every variety of trumped up excuse in order to procure more money, and, if successful, immediately pocketing the coins without a word of thanks, and immediately asking for more. This sort of conduct is, unfortunately, a characteristic of the people of Kashmir, and must be tolerated as a counterpart to the splendid sport and magnificent scenery enjoyed in their country.

After tea, I set out with a gun towards a chain of small jheels on the far bank of the river, accompanied by the boatman's son, to await in the cover of some small trees the evening flight of duck. I had a most unsuccessful time, bagging one lofty mallard which came over early, and getting no further shot, so, that very evening, before returning to the houseboat, I proposed to go elsewhere, a decision which was welcomed by the shikari, who suggested a place further down the river, where, he stated, there was not only excellent duck and snipe shooting, but also in the very early mornings wild geese to be bagged. This sounded good, so I gave orders for the houseboat to be moved next morning after breakfast to its new locality, which we reached the same evening, too late unfortunately for any shooting that day.

Here, for the next month, I had the finest sport it has ever been my lot to enjoy, and I shall never forget those winter days, when I waited, long before dawn, numb with cold, for the geese to flight; when I walked over the sunlit marshes in search of snipe, or sat motionless in a ramshackle boat amidst the reeds, in the evening, listening for the first wing-beats of

the incoming duck. On the right bank of the river, one mile away, lay an enormous unapproachable marsh, from which the villagers collected a sort of three-horned root, known as "cingara." Into this marsh, in the evening, piercing the sunset like arrows, the geese flighted literally in their hundreds, coming from the great jheels of Haigam and Hokra, whither they returned in the morning before sunrise, offering to a sportsman willing to spend two chilling hours awaiting the dawn on the edge of the marsh chances of a moderate bag.

Every morning, at half-past-three, I was awakened by my faithful bearer with a cup of scalding tea, and scrambling sleepily into some clothes, set out with my shotgun and a cartridge bag full of number one shot, for the marsh, which I approached as closely as I dared. Here I waited until, in the darkness, the geese commenced to call. Slowly, in ever-increasing volume, the song was taken up by the remainder of the flock, until, in the first red flush of dawn, when light stole quietly from the valley, and moulded with soft fingers the outline of the hills, they rose with a great roar of beating wings. In lines and chevrons the great skeins sailed over, soon alarmed, soon passing high out of shot, but not before, in the first minutes of the flight, my vigil had been rewarded by two or three brace of birds.

After the early morning shoot, having returned to the house-boat and eaten a colossal breakfast, I set out after a short rest to look for snipe on the edges of the jheels on the far side of the river. This variety of snipe shooting I found tricky and difficult, as the ground near the water where the birds lay was very soft, and covered with head-high reeds interlaced with an aggravating tangle of cobwebs, so that when a snipe was flushed, a momentary glimpse only was afforded. I discovered, after a few days, that the better sport in this case was obtained by beating, stationing a gun at a gap in the reeds, encircling the jheel, and driving the birds round the edge. I found by adopting this method that snipe were much more plentiful than I had imagined when walking up and offered excellent shots, although driven snipe are not so difficult to hit as those walked-up, especially if the ground is at all soft.

One day, returning to the house-boat about noon, I came across a gruesome relic—a human skull. What was its history I could not tell, though most probably it was a memento of some shipwreck, which, I believe is a not uncommon occurrence in the Wular Lake, when great sudden storms sweep down from the surrounding hills and smash like eggshells the long, flimsy, inadequate, cockle-shell boats used by the fishermen, strewing the shore with poor fragments of mortality such as I held in my hand. The skull was buried with all honours, and I sincerely hope that the fled soul, though shriven by an infidel and no true follower of Mahomet, may attain the halls of Nirvana.

In the evenings, hidden from sight in the reeds, cramped in a small punt, I awaited the flighting of the duck. To me, there is no finer form of sport than this, and I am sure that every lover of feathered game will agree.

The raw darkness of the dawn has gone, the exertions of midday under the direct sun are over, there is a quiet, the pre-nocturnal quiet of early evening and a colour—the soft hues of late afternoon or the wine of sunset—that seems to lift time and place out of the ordinary world into the supernatural, and carry the sportsman, hushed by the magic of fading day, into a finer and an older world, where mundane things do not matter, and man lives only for the dawn and the sunset and the cry of birds. Everything is silent until the sun has gone, darkness has fallen, and the gunner, every nerve alert, hears at last the winnowing of incoming wings, and sees, straining his eyes against a friendly cloudbank or the cheating radiance of the moon, the flash of the shadowy forms as they seek their evening haunts.

Duck-flighting is the poetry of sport, and I would desert spear and rod, rifle and saddle, for the quiet, reedy tarn, a thing of no great beauty in itself, but where, in the hush of evening, awaiting the flighting birds, one can hear the whispering of the Gods.

Current Literature.

AUSTRIA.—**Circular of the 10th August, 1933, and a note on Bang's disease in man.**[1]

The increasing number of cases of human infection by Bang's disease has led the Federal Minister of Social Administration to pay closer attention to this question. It is desired to obtain a complete summary of cases of this kind which will serve as a basis for a campaign against the disease. To this end the Minister, in collaboration with the Minister of Agriculture and Forests, has drawn up a notice and a questionary, which are issued gratis, and the authorities concerned are invited to apply for supplies sufficient for distribution to the Medical Officers of Health in their areas. Medical Officers of Health are required to make an extensive investigation of each human case brought to their notice, using for this purpose the questionary and returning it, when filled up, to the Central Ministry. Medical Officers and Veterinary Officers must work together in this matter.

There follows an interesting note on Bang's disease in man which begins with a short summary of the main features of the disease, its mode of transmission, the complications and its diagnosis. There then follow some notes on the spread of the disease in Austria and suggestions for its prophylaxis and treatment.

On its spread, it is acknowledged that the disease is more prevalent in Austria than has been accepted or reported by the medical profession. Naturally, agricultural labourers are particularly exposed to infection, but

[1] See *Bull. Office Internat. d'Hyg. Pub.*, 1934, v. 26, 795.

Veterinary Officers are also exposed to danger since they come in close contact with infected animals under treatment. It is thought probable that, owing to the extension of infection among livestock, the number of human cases will increase in the future unless suitable measures are taken for diagnosing and preventing the disease.

Prophylaxis lies particularly in the domain of veterinary hygiene, but the medical profession can assist to a great extent by adopting measures for general hygiene. Infection *per os* can only be prevented by boiling or pasteurizing all milk consumed. One or other of these processes should also be carried out in the preparation of cream, butter and cheese. Personal cleanliness is an important factor and, in the case of veterinary surgeons who have to handle infected animals, additional safeguards are necessary, such as avoiding contact as far as possible and wearing rubber gloves. Persons with cracks or scratches on their hands should not handle infected animals or, in case of necessity, should first thoroughly cleanse their hands in a disinfectant solution or should use a lysol or cresol soap followed by a liberal painting with tincture of iodine before and after contact. Isolation of contacts is not, so far as is known, of much value.

As for treatment, vaccinial therapy is the only one which is thought at present to be of any value. Bang's vaccine is furnished by the State Serotherapeutic Institute. It consists of a sterilized emulsion of Bang's bacillus; the excipient is a solution of sodium chloride to which 5 per cent phenol has been added. The vaccine can be obtained in boxes of six ampoules containing respectively 10, 25, 50, 100, 250 and 500 million organisms per cubic centimetre. Progressive vaccination is recommended beginning with 10 millions and increasing the dose in stages, at intervals from four to five days. Severe reactions (severe local erythema, tumefaction and fever) should be avoided. If they occur the last dose should be repeated instead of proceeding to the next higher one. The vaccine is given subcutaneously or intramuscularly.

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SMITH, G. **The Dental Aspects of Maternity and Child Welfare.** *Brit. Dental J.* 1934, v. 56, 477-84.

The necessity for a clean and dentally sound mouth in a woman, a potential mother, needs no labouring, and to obtain this much-desired condition it is necessary to begin with the mother before the child is born, and attention to her diet and teeth throughout infancy and early childhood particularly, and so on to the full-grown adult.

Mr. Grantley Smith speaks of the opportune efforts of the British Dental Association in these directions, especially on the subject of the hiatus in the treatment between the school-leaving age and that at which the girl comes under the National Health Insurance. He feels that the Local Authorities might make arrangements for the treatment of adolescents by the exercise of powers they already possess. The reluctance of the

expectant mother to undergo any dental treatment is sometimes encouraged by the vacillation of the medical opinions as to the advisability of this, or at any rate of pressing for its carrying out. This makes it all the more desirable that every young woman, whether married or single, should receive treatment before there is any possibility of having to face the stress of pregnancy and lactation.

At the present time facilities for treatment are only given during these periods and the author pleads for their extension to all married women up to the age of 45, possibly with an income limit. Two local authorities are quoted as having such schemes in successful operation at the present time. The sound principles of dietetics should be taught, insistence on half yearly dental examination should be stressed, and that no stone be left unturned the use of the toothbrush should be explained.

In conclusion the author deals with the difficulty the dental officer experiences in obtaining access to the pre-school child. The popular belief that the deciduous dentition is unimportant is a serious obstacle to progress. There are, however, signs of improvement. Conservative work must be undertaken with caution so that prejudice may be overcome and not justified. The position of the school dentist who is required to undertake maternity and child welfare work is criticized with sympathy for the dubious position of the man who has to serve two masters. LILIAN LINDSAY.

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BUNTING, R. W. **Bacteriological, Chemical, and Nutritional Studies of Dental Caries by the Michigan Research Group. A Summary.** *J. Dental Res.* 1934, v. 14, 97-105. [13 refs.]

This summary of a series of investigations by the Michigan Group on dental caries must give great satisfaction to those who have held so steadfastly to the Miller theory of dental caries and to its counteraction by a diet low in sugar content. The three lines on which the experiments were based were those of bacteriology, chemistry and nutrition; separate reports on these results have already been published and now Dr. Bunting has given a judicial summing up as to the bearing of all three reports upon the question of immunity or susceptibility to dental caries. Unlike many investigations the results are clear and unmistakable. That the bacillus discovered by Macintosh, James and Lazarus-Barlow plays the leading part in susceptibility or otherwise is proved in all cases under observation; it was found in large quantities in mouths where caries was rampant, and was absent or only present in insignificant amounts in caries-free mouths and when implanted in these disappeared immediately. It was found that in the blood-serum of immunes there were agglutinins against the bacillus which might possibly suggest a line of treatment by vaccines.

Another theory greatly favoured of late that the Ca and P content of the saliva is of moment seems to be discredited by the present investigations, for these elements bore no consistent relation to caries nor was there any connection between immunity and total alkalinity of the saliva.

In an orphanage where the diet was deficient in all the constituents considered necessary for immunity 75 to 80 per cent of the children were caries free. The diet was uniform and regular, low in calories, and inadequate in Ca and P as well as in vitamin D. Little milk and no butter, little meat daily, vegetables throughout the year mostly raw, a raw apple ended the meal. Sunday was the only day on which a sweet dessert was served. The total caloric diet consisted of starch and cereals, no candy at any time nor was any sugar placed on the table.

In another group a study was made of food habits which resulted in showing that those who had good appetites, were not dainty as to the kind of food, had no craving for sweets, and ate heartily were in the caries-free group, while those who were fanciful about their food, had poor appetites, were always consuming large quantities of sugar, were found to be caries susceptible with saliva containing quantities of *B. acidophilus*, although there was no consistent difference in the chemical constituents of the saliva of the two groups.

Another group receiving an adequate balanced diet was tested by the addition of a considerable quantity of sugar with the result of an increase in caries.

Dr. Bunting finds that heredity, and what he calls individual characters may play a part in immunity irrespective of diet, for some caries-free children could eat any food and any quantity of sugar with impunity. In others the disease could not be inhibited by any ordinary satisfactory diet; but when starch and sugar were reduced there was a marked decrease of the amount of *B. acidophilus* in the mouth. The number of immunes was, however, small. LILIAN LINDSAY.

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SAUNDERS, J. C. **The Occurrence of Diphtheria in "Immunized" Persons.** *Irish J. M. Sci.* 1933, Nov., 611-19. [13 refs.]

This paper is of considerable importance since it analyses cases of alleged diphtheria in persons actively immunized against diphtheria. From June, 1929, to the end of 1932, 8,027 children in Cork were immunized completely or partially, and of these 78 were officially reported as suffering from diphtheria. Of this number the diagnosis was not confirmed in 33 cases, and in 18 immunization was incomplete or insufficient time had elapsed for the development of immunity. In 27 cases the necessary conditions for the development of immunity had been fulfilled, but in 9 the diagnosis was extremely doubtful and in 4 doubtful, whilst in the remaining 14, 12 had not been Schick tested after immunization. In all there were only two known negative reactors, both secondary to immunization, who developed definite diphtheria. In cases which had received protective inoculations the response to serum treatment was rapid, with two exceptions, and in all recovery was complete. The author has been much impressed with the results from alum toxoid, and apart from two cases in

which a weak preparation was employed, has seen no diphtheria among 579 children inoculated with this prophylactic. The elimination of diphtheria in inoculated persons, in the opinion of the author, would seem to depend on the production of more efficient antigens. A. JOE.

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SWYER, R. **Toxoid-Antitoxin Floccules, Alum Toxoid and Formol Toxoid in Immunization against Diphtheria.** *London County Council Ann. Rep.* 1932, v. 4, Pt. 3 (Med. Supp.), 57-61.

The antigenic value and the tendency to produce reactions of various diphtheria prophylactics were compared. The observations were made on nurses at a fever hospital and on children at two residential schools. The three prophylactics compared were toxoid-antitoxin floccules, formol-toxoid and alum toxoid.

The conclusions were that all three antigens are good immunizers; the formol toxoid (Lf 20) being the most certain and rapid in action, alum toxoid next in antigenic value and the floccules last. The liability to reactions was greatest with alum toxoid (in 45·5 per cent of cases) and least with floccules. Formol toxoid is the antigen of choice except in those cases particularly liable to reactions, when floccules should be used. Liability to produce reactions is not an index of rapid immunizing properties. In one institution of normal children it was noted that reactions were much more frequent among the girls than among the boys (58·7 per cent of inoculations giving rise to reactions in the former as against 9·4 per cent in the latter). C. C. OKELL.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 9.

BLANC, G. La vaccination contre le typhus exanthématique. **[Vaccination against Typhus.]** *Paris Méd.* 1934, v. 24, 471-4. [14 refs.]

After alluding to the methods of vaccination against typhus most frequently employed, viz., those of Castaneda-Zinsser and that of Weigl, Blanc gives the following account of his own investigations. The virus of murine typhus which is only feebly pathogenic for man was isolated from Casablanca rats and inoculated into guinea-pigs, on which it conferred immunity against other strains of murine typhus (Toulon virus) and also against ordinary typhus. It was then found that man could be immunized against ordinary typhus by an inoculation of Toulon murine typhus, the virus of which had been attenuated by the addition of ox bile. Further experiments proved that a guinea-pig infected with murine typhus could supply sufficient vaccine to protect 1,000 persons against ordinary typhus, although the duration of the immunity could not be determined. Vaccination against typhus should be reserved for those who are brought into professional contact with patients and repeated yearly. It should also be employed for groups of individuals in a typhus focus and in the case of an epidemic for the whole population. J. D. ROLLESTON.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 9.

Reviews.

MODERN ADVANCES IN DISEASES OF THE THROAT. By Arthur Miller, F.R.C.S.Ed., D.L.O. London: H. K. Lewis and Co., Ltd. 1934. Pp. xii + 120. Price 10s. 6d. net.

This small book should not be confused with the well known "Recent Advances Series" of books which in many ways it resembles.

It does great credit to the industry of the author, as a very wide range of authorities has been consulted, evidenced by the extensive bibliography attached to each section of the work.

The title is rather a misnomer as the whole subject of diseases of the throat is not dealt with, but only the tonsils and adenoid growths, with a very short and incomplete chapter on malignant disease of the tonsil and soft palate.

Much of the subject matter is excellent, and is a mixture of the ordinary textbooks on the subject and the more modern views that have been advanced in recent years.

The first three chapters on the anatomy and development, the physiology and bacteriology of the tonsil are interesting and well summarized.

The tables taken from Kaiser showing the end results on groups of children who have been tonsillectomied, compared with those who have not been operated on, is worth study and bears out the plea for the operation in suitable cases.

The discussion on the methods of removing tonsils is hardly recent, and rather more space is given to it than seems necessary in a work of this nature.

There is a short section on diathermy removal of tonsils.

The section on adenoidectomy is largely devoted to the advocacy of the La Force adenotome; the methods of employing it and its advantages are well given.

The final chapter on malignant disease of the tonsil and soft palate, in which diathermy is strongly advocated, hardly does justice to the recent work on radium and is not very convincing.

It is a little difficult to decide for what class of reader the book is likely to be most useful. For the beginner on the subject it is too incomplete, and for the specialist contains much that is elementary. For the general practitioner it is likely to be useful as a guide to the present position of our knowledge in the methods of dealing with diseases of the tonsil and adenoid growths in the nasopharynx.

The text is well written and the book and illustrations are excellently produced by the publishers.

J. W. W.

THE SCIENCE OF SIGNS AND SYMPTOMS IN RELATION TO MODERN DIAGNOSIS AND TREATMENT. By R. J. S. McDowall, D.Sc., M.B., F.R.C.P.Edin. London: William Heinemann (Medical Books), Ltd. 1934. Pp. xv + 542. 21s. net.

The third edition of this already classical work comes within a year of the publication of the last.

The book has already been accorded a very favourable reception from the medical profession.

This edition brings the work completely up to date, and is welcome not only as a scientific exposition of the cause of symptoms, but also as a most readable and interesting book.

The whole ground of physiology in relation to clinical medicine is covered, and problems which in an ordinary textbook of medicine tax the powers of the reader to assimilate and understand, become clear in the simple and orderly manner in which the author deals with them.

We thoroughly recommend this book to all Service libraries.

J. H.-S.

RESEARCHES PUBLISHED FROM THE WARDS AND LABORATORIES OF THE LONDON HOSPITAL. 1933. London: H. K. Lewis and Co., Ltd.

The 1933 collection of papers covers a wide field in both medicine and pathology, and consists of monographs which have already been published in various scientific journals.

Of the more outstanding papers we may mention Debenham's analysis of the causes of hæmaturia—an important contribution to the study of this condition.

Evan's paper on aortic coarctation consists of a detailed study of twenty-eight cases of this congenital defect, and is of great interest, as is also the critical discussion of the use of drugs in angina pectoris by Evans and Hoyle.

We have only mentioned three of the large number of papers included in this volume, but many others are of considerable importance.

The volume will be a welcome addition to reference libraries.

J. H.-S.

THE ROLE OF METALS IN INTRACELLULAR REACTIONS. London: Tonicity Laboratories Ltd. Pp. 72.

This small book gives an interesting resumé of the various stages through which the study of metabolism and nutrition has passed from 1870, when Lavoisier first arrived at the conclusion that the basic process of life was that of oxidation, up to the second decade of the present century when Hopkins initiated the work on accessory food substances, which has resulted in the identification of the principal vitamins.

As a later step in the same field of study consideration is given to the organic constituents of the body and the part played by these in the interior economy.

The final chapters deal with the functions of magnesium as an activator of the enzymes concerned with oxidation—reduction reactions, and show that when tissue cells become depleted of this metal metabolism will cease. The benefits to be derived from the administration of magnesium in the form of well-proportioned doses of assimilable halogen salts, marketed under the name of Halmagon products, are pointed out with a brief description of this form of treatment as applied to various pathological conditions.

MANIPULATIVE TREATMENT FOR THE MEDICAL PRACTITIONER. By T. Marling, M.D., M.B., Ch.B., D.P.H., R.C.P.S.Eng., D.M.R.E. London : Edward Arnold and Co. Pp. viii + 133. Price 10s. 6d.

This book will well repay reading, not only by those who are keen on manipulative treatment, but also by those who wish to see a very fair view of a controversial subject. The detail of all manipulative movements is well described.

The first seven chapters deal with generalizations on the subject. Chapters eight to eighteen concern the different parts of the body, while the last chapter is devoted to the choice of cases for manipulative treatment.

The author shows that the scope for this type of treatment is yearly increasing as the subject becomes more widely known.

The book deserves to be widely read. G. C. A.

MODERN TREATMENT IN GENERAL PRACTICE. Edited by C. P. G. Wakeley, D.Sc., F.R.C.S., F.R.S.E. London : *The Medical Press and Circular*. 1934. Pp. viii + 426. Price 10s. 6d.

This addition to the Practitioner's library appears as a volume of moderate size to which a large number of well known writers contribute special articles.

It appears to us a very useful book which covers much ground which is not fully dealt with in the ordinary medical textbooks.

Among a wide diversity of subjects we may mention for their special excellence the treatments of diabetic and insulin comas, the discussion on erythema nodosum, and the chapter on acute abdominal conditions in children. These but serve to illustrate the general high standard of this book, upon which we congratulate the editor. It is a work which every practitioner will welcome, and its success should be assured.

J. H.-S.

SCHISTOSOMIASIS. By Rameses Girges. London: John Bale, Sons and Danielsson. 1934. Pp. xii + 529, with 185 illustrations. Price 25s.

This useful and conveniently sized volume contains a mine of information on all aspects of infestation with the Schistosome parasites. The author is well qualified by experience to write on this subject, as he is, and

has been for years, engaged in practice in the heart of the Egyptian Delta, one of the most intensively infected endemic areas of this disease in the world. He has set out to review the historical, classical, laboratory and preventive features of this group of diseases and has succeeded admirably in this task. The result has been the compilation within brief compass of all the more important facts concerning these infections. In addition, lines on which further research should prove fruitful have been indicated. The chapter on prophylaxis is of great interest, and is especially instructive considering the active campaign conducted by the Egyptian Government Department of Public Health in the interest of general prevention of the infection.

The volume is excellently produced; the illustrations are profuse and well chosen. H. M. P.

An Introduction to Practical Bacteriology. By T. J. Mackie, M.D., D.P.H., and J. E. McCartney, M.D., D.Sc. Fourth Edition. Edinburgh: E. and S. Livingstone. 1934. Pp. viii + 504. Price 12s. 6d. net.

This deservedly popular book has now reached its fourth edition. The general form has not been changed, but the addition of new material to the letterpress has increased the bulk of the volume to over 500 pages. The most valuable parts of the book are those dealing with essentially practical points such as the bacteriological diagnosis of intestinal infections. The sections dealing with protozoal diseases appear to have missed revision and the inaccurate and confused descriptions of some of the parasites that appeared in the earlier editions have not been changed. Nevertheless the book remains one of the most valuable of the smaller laboratory manuals and it can be recommended to the senior student preparing for such examinations as the Diploma in Public Health.

Correspondence.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

ULNAR PARALYSIS.

Sir,—The account of two cases with pressure symptoms referred to the brachial plexus reported by Drs. Smithers and Yeo in the Journal of October, 1934, prompts me to record what was, to me, an unusual cause of traumatic ulnar palsy in an officer who recently consulted me with "pins and needles" in his right little and ring fingers and ulnar border of the palm. The condition was causing him much discomfort and worry.

At first no traumatic history was admitted and radiograms showed no presence of cervical rib or other abnormality.

When a definite thickening of the nerve was felt and demonstrated below the groove in the internal epicondyle and the point stressed that it was probably traumatic in origin, he admitted the interesting informative fact that "he always rested his elbow across the top of the glass in the open window of the door of his car when driving and had done so for ages."

The constant vibrations and bumps were apparently sufficient to account for the condition.

Cadet Hospital,
Royal Military Academy,
Woolwich,
October 11, 1934.

I am, etc.,
R. HEMPHILL,
Major, R.A.M.C.

Notices.

LONDON MEDICAL EXHIBITION.

NEW HALL, ROYAL HORTICULTURAL SOCIETY, WESTMINSTER, S.W. 1.
October 15-19, 1934.

AT the Burroughs Wellcome and Co. Stand the display included the following products :—*Digoxin* : A pure stable crystallized glucoside isolated from leaves of *Digitalis lanata.* It can be employed in all cases where drugs of the digitalis group are indicated ; it is said to act rapidly when given by mouth, and if the urgency of the case so dictates, may be administered intravenously to produce almost immediate effect. *Insulin and Associated Products* : "Wellcome" Brand Insulin (Cryst.) is made available commercially for the first time. Pure crystalline insulin is stated to be used in the preparation of this product. Products and outfits for use in "Soloid" Benedict Test for urine sugar were also exhibited, together with "Tabloid" "Saxin," a valuable sweetening agent for patients for whom sugar is prohibited. *Ergotoxine Ethanesulphonate* : The most stable salt of the alkaloid ergotoxine is available as "Tabloid" and "Tabloid" Hypodermic Ergotoxine Ethanesulphonate and in "Ernutin" which presents 0·033 per cent of this salt. "*Tannafax*" : "Tannafax" presents for the treatment of burns tannic acid in a non-oily, non-greasy jelly which has a water-soluble base. It can be easily bathed off when subsequent treatment demands. Although of comparatively recent introduction it has won wide acceptance in both private and hospital practice. *Animal Substances* : A comprehensive range of "Tabloid" Animal substances is exhibited which includes preparations of the thyroid, parathyroid, pituitary, and suprarenal glands together with a number of the lesser known glandular preparations. *Serological Products*: Prepared and standardized at The Wellcome Physiological Research Laboratories, Beckenham, Kent. Every precaution

is taken to ensure their stability and freedom from toxicity. Amongst those exhibited the following are included: "Wellcome" Anti-pneumococcus Serum—(both concentrated and unconcentrated); "Wellcome" Concentrated Diphtheria Antitoxin Globulins; "Wellcome" Concentrated Streptococcus Antitoxin (Scarlatina) Globulins; "Wellcome" Concentrated Gas-Gangrene Antitoxin (Perfringens) Globulins.

CHADWICK PUBLIC LECTURES, NOVEMBER TO DECEMBER, 1934.

Date and Time	Place	Lecturer	Subject	Chairman
November. Wednesday, 7. 8.15 p.m.	LONDON. Royal Society of Tropical Medicine and Hygiene, 26, Portland Place, W.1.	Margaret Fishenden, D.Sc., F.Inst.P.	Health and the Indoor Climate	Sir George W. Humphreys, K.B.E., M.Inst.C.E. Chadwick Trustee
Friday, 9. 7.30 p.m.	HUDDERSFIELD. Large Hall of the Technical College	Dr. Matthew B. Ray	Fifty Years of Public Health Progress	Dr. Gibson, Medical Officer of Health, Huddersfield
Friday, 23. 5,30 p.m.	LONDON. Lecture Hall of The Royal Society of Arts. John Street, Adelphi, W.C.2	Sir Raymond Unwin, P.P.R.I.B.A.	Good Housing—The Basis of Individual and Social Health	Sir William J. Collins, K.C.V.O., M.D., M.S., F.R.C.S., B.Sc. Chairman of the Chadwick Trustees
December. Monday, 10. 5.30 p.m.	The Lecture Theatre, London School of Hygiene, Keppel Street, Gower St., W.C.1	Dr. F. R. Seymour (Ministry of Health)	Men and Masses; Phases of Man's Relation to Disease — (1) Cure of Existing Disease; (2) Prevention by Indirect Attack; (3) Prevention by Direct Attack. The Future	Sir William J. Collins, K.C.V.O., M.D., M.S., F.R.C.S., B.Sc. Chairman of the Chadwick Trustees

All who attend these Lectures are asked to sign their names, stating whether Mr., Mrs., or Miss, and to write a permanent address to which notices of future lectures may be sent. Books for these signatures and addresses are provided at the door of the Hall.

ERRATUM.

"Climatic Bubo and its Treatment." JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, No. 4, vol. lxiii, October, 1934, page 256, line 20, *for* "puncture" *read* "injection of vaccine."

No. 6. December, 1934. Vol. LXIII.

Journal OF THE Royal Army Medical Corps

ISSUED MONTHLY

EDITOR.
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CONTENTS.

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Price Two Shillings and Sixpence net

VOL. LXIII. DECEMBER, 1934. No. 6.

Journal of the Royal Army Medical Corps.

Original Communications.

SANDFLY FEVER ON THE INDIAN FRONTIER.[1]

A PRELIMINARY NOTE ON SOME LABORATORY INVESTIGATIONS.

BY LIEUTENANT-COLONEL H. E. SHORTT, F.Z.S.
Indian Medical Service.

MAJOR L. T. POOLE, D.S.O., M.C., M.B., D.P.H.
Royal Army Medical Corps.

AND

ASSISTANT SURGEON E. D. STEPHENS, D.T.M.
Indian Medical Department.

[Received for publication January 2, 1934.]

MATERIALS AND METHODS.

SANDFLY FEVER, under its multiplicity of names, appears to have a world-wide distribution. The similarity of the clinical manifestations throughout the range of the disease is *prima facie* evidence that the disease, wherever met with, is one definite entity, but this evidence would be strengthened were it supported by a like similarity in laboratory findings.

Laboratory findings have already been recorded by various workers, and it has been our endeavour to repeat these observations, as far as possible, in order to demonstrate the identity, or at least essential similarity, of the Indian form of the disease with that occurring in other parts of the world.

It was obvious to us that much of the work involved in repeating these observations in India could not conveniently be carried out within an area

[1] Reprinted by permission from the *Indian Journal of Medical Research*, xxi, April 4, 1934.

where sandfly fever was endemic. It was therefore decided that materials for investigation—blood from sandfly fever cases and sandflies fed on such cases—should be collected in Peshawar and immediately despatched by post or messenger to Kasauli. Here the actual experimental work could then be carried out in a known non-endemic area where there would be no necessity for protecting the volunteers used from bites of sandflies other than those used in the experiments.

Even these precautions did not remove all the complications as we would have wished to do in order to make the experiments perfect. Thus, we had to utilize as volunteers such Indians on the staff of the Pasteur Institute, Kasauli, as were willing to offer themselves. Some of these, who were hill-men, had presumably never had sandfly fever and were therefore considered good subjects; others, however, were plainsmen and had at various times been in areas where they might at some time or other have had sandfly fever and so gained a certain immunity. These were difficulties which there was no way of surmounting with the facilities available to us.

As it was not known in what form blood was likely to conserve most efficiently the infective principle it was decided to send it in the three following forms:—

(*a*) Citrated whole blood, i.e. 5 cubic centimetres of blood in 15 cubic centimetres of 2 per cent sodium citrate solution.

(*b*) Glycerinated whole blood, i.e. 5 cubic centimetres of blood in 5 cubic centimetres of 50 per cent glycerine.

(*c*) Citrated-glycerinated blood, i.e. 5 cubic centimetres of (*a*) mixture in 5 cubic centimetres of 50 per cent glycerine.

As the work was carried on during the middle of the hot weather, and the journey from Peshawar to Kasauli occupied approximately twenty-four hours, and as the blood was taken on the day previous to its despatch and sent either by messenger or post without any special precautions for cooling it, it will be evident that there was every likelihood of any but a fairly resistant virus dying out between the taking of the blood at Peshawar and its use in Kasauli. The average interval elapsing between the two operations was sixty hours.

Previously Recorded Laboratory Findings.

The most important laboratory findings as recorded by previous workers on sandfly fever are enumerated below and will later be considered in more detail in relation to our own observations.

(1) *Blood taken from a patient on the first day of the fever when inoculated into man produces a typical attack of the fever after the usual incubation period* (Doerr, Franz and Taussig, 1909; Birt, 1910).

(2) *Blood passed through a fine filter can still convey the typical fever when inoculated into a susceptible person* (Doerr, Franz and Taussig, 1909; Birt, 1910).

(3) *Phlebotomus flies fed upon a patient suffering from the fever, when*

taken to a non-endemic area and fed on susceptible persons, convey the disease to the latter (Doerr, Franz and Taussig, 1909; Birt, 1910).

(4) *The flies do not become infective until seven to ten days after their meal on a fever case* (Doerr, Franz and Taussig, 1909; Birt, 1910).

(5) *The incubation period varies between three and a half days and seven days* (Doerr and Russ, 1909; Birt, 1910).

(6) *The virus retains its infectivity for a week* in vitro (Birt, 1910).

(7) *Experimental animals are immune to the disease* (Birt, 1910).

(8) *No visible causative agent has been demonstrated in the blood by direct microscopical or cultural examination* (Doerr, Franz and Taussig, 1909; Birt, 1910).

(9) *A Leptospira has been isolated from cases of so-called sandfly fever* (Whittingham, 1921; Nervoort, 1922).

In order to give the clearest account of our own findings and to indicate where they confirm or differ from those recorded by the other workers referred to, it has seemed to us most convenient to deal with them *seriatim* under the headings we have used above in summarizing the conclusions of these workers.

(1) *Blood taken from a patient in the first day of the fever when inoculated into man produces a typical attack of the fever after the usual incubation period.*

The impression one gathers from the literature quoted is that the virus has disappeared from the peripheral circulation by the second day of the disease. It was on this account that the majority of the blood samples sent to Kasauli from Peshawar for test were taken on the first day of the disease. In Table I given below are recorded the results of inoculating the bloods into volunteers in Kasauli from the point of view of the infectivity of the blood on the first and second days of the fever:—

TABLE I.

Showing the Number of Infections obtained by Inoculating into Volunteers the Blood of Sandfly Fever Cases taken on the First and Second Days of the Attacks.

	Number of bloods used	Number of cases of fever produced	Typical	Modified*
First day bloods ..	10	7	6	1
Second day bloods ..	4	2	1	1
Totals ..	14	9	7	2

* *Modified Cases.*—No case was considered as a "positive" unless there was actual fever. Those cases in which the fever was only of moderate intensity and short duration were called "modified cases." The discomfort, in the form of various aches, pains and general malaise of some of the cases was considerable, and often lasted for some days beyond the actual duration of the fever.

It will be seen from the table that, contrary to the impression conveyed by previous work, there is probably a considerable percentage of cases in which blood is still infective on the second day of the fever. No investigation on this point was made beyond the second day of fever.

The dose of the inoculum varied with the concentration of the blood,

an attempt being made in each case to give the equivalent of 0·7 cubic centimetre of whole undiluted blood.

As regards the best method of sending blood for the experiments the numbers used were too small for us to come to any decision but, in practice, successful transmissions of fever to man or monkey were produced by all the methods mentioned as well as by direct inoculation of fresh whole blood from fever cases to volunteers. The latter process was carried out by inoculating the blood of fever cases produced in Kasauli from the Peshawar bloods into a second series of volunteers. The actual figures for these experiments are given below in Table II :—

TABLE II.

Showing the Number of Infections of Sandfly Fever produced in Man by Blood Inoculation according to the Form in which the Blood was used.

Condition of blood	Number of bloods inoculated	Number of fever cases produced	Typical	Modified
Citrated	14	7	5	2
Glycerinated whole blood* ..	—	—	—	—
Citrated-glycerinated blood	10	2	2	—
Fresh whole blood	1	—	—	—
Totals ..	25	9	7	2

* Glycerinated whole blood was used for injection in monkeys only.

(2) *Blood passed through a fine filter can still convey the typical fever when inoculated into a susceptible person.*

The quantities of blood received by us were comparatively small and, being mostly used in the direct inoculation experiments, not much was available for filtration. Such experiments as were done, however, showed that the infective virus was capable of passing a comparatively fine filter and retaining its virulence. The filters used by us were L3 and L5 Chamberland candles.

The results of the experiments are given in Table III. The dose of filtrate used for inoculation varied from 3·8 cubic centimetres to 10 cubic centimetres :—

TABLE III.

Showing the Results of Filtration Experiments.

Condition of blood before filtration	Number of filtrates inoculated	Number of fever cases produced	Typical	Modified
Citrated whole blood ..	4	2	2	—
Citrated-glycerinated blood ..	2	1	1	—
Totals ..	6	3	3	—

The temperature charts of all the cases of sandfly fever induced in Kasauli by the inoculation of blood, whatever its form, or filtrates of blood, are shown in Chart 1.

(3) *Phlebotomus flies fed upon a patient suffering from the fever when conveyed to a non-endemic area and fed on susceptible persons convey the disease to the latter.*

Eight batches of laboratory-bred *P. papatasii* which had been fed on cases of sandfly fever at Peshawar or Landikotal were received by post or

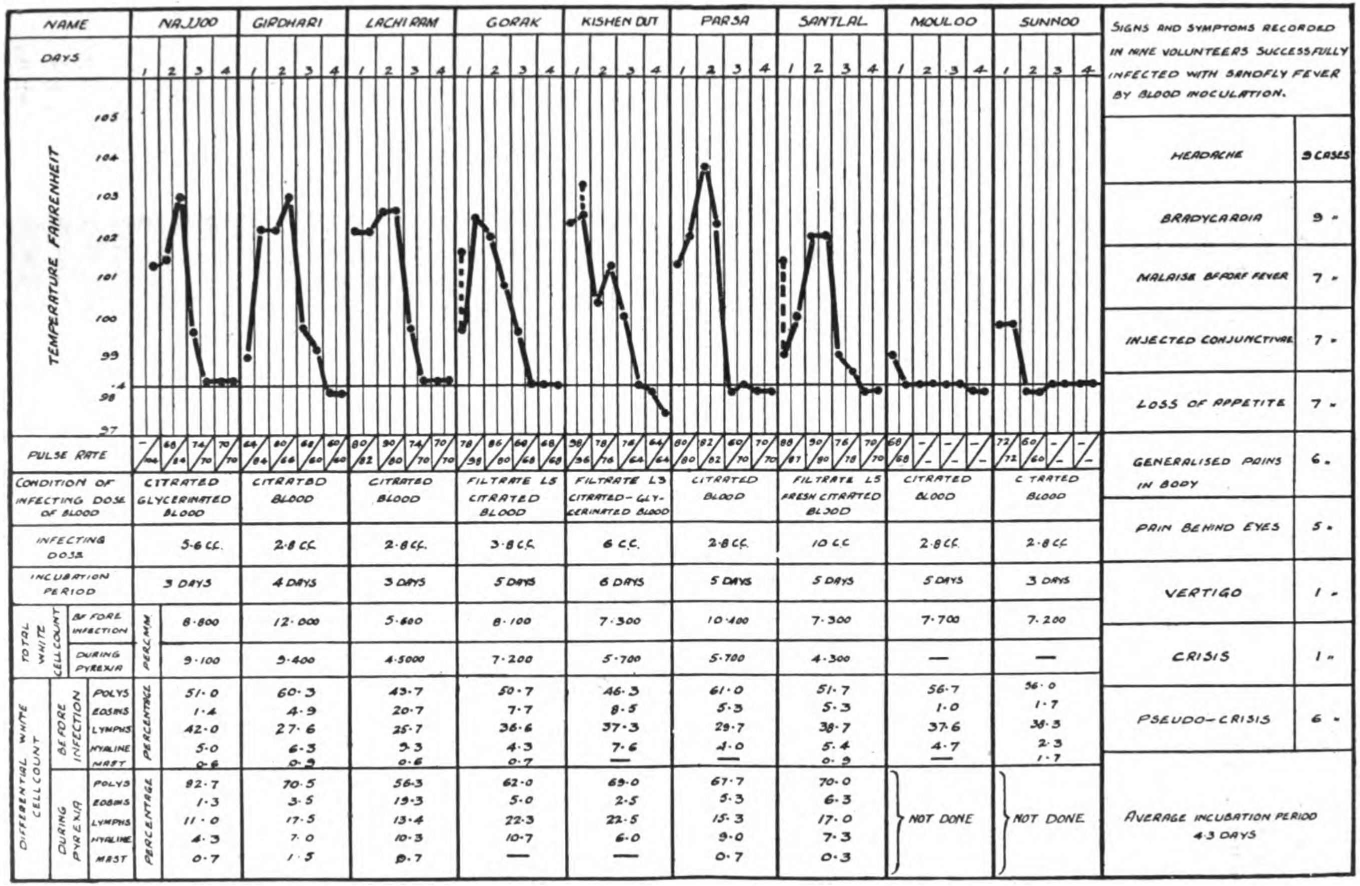


CHART 1.—The temperature charts of, and other clinical observations made on cases of sandfly fever induced in volunteers by inoculation of infective blood.

passenger train in Kasauli. These flies were sent in the mosquito despatch boxes devised by Barraud (1929). The total number of flies despatched was 110. Of these 69 arrived alive, 32 were dead and 9 were not accounted for. Of the 69 flies which arrived only 19 fed on volunteers. Eight volunteers were used. As the flies when received in Kasauli had fed only three or four days previously it was considered that the third and subsequent feeds were

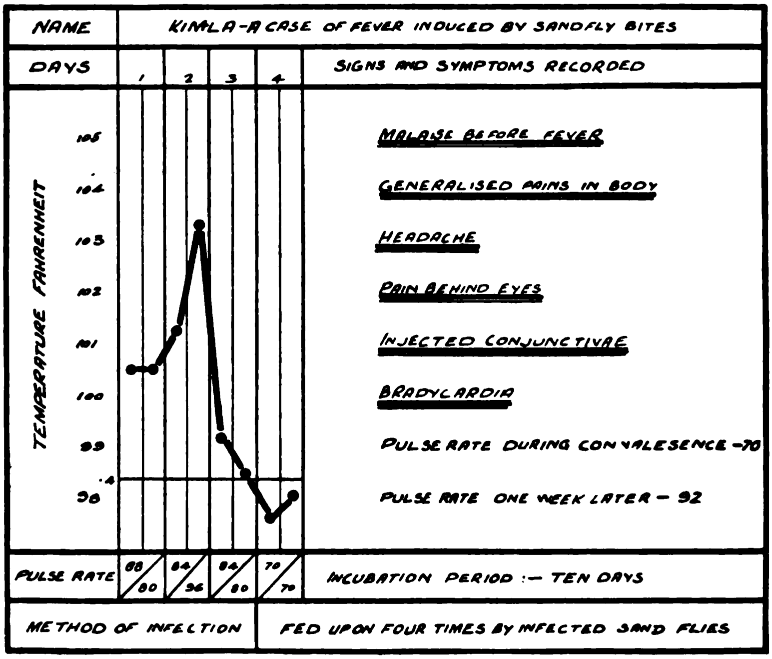


CHART 2.—Sandfly fever induced by bites of sandflies.

most likely to be the infective ones. The second feed (or first in Kasauli) was given to keep the flies alive and the third and subsequent feeds were on the most suitable volunteers. Of the 8 volunteers, all were fed upon once, 5 were fed upon twice, 1 was fed upon three times, 1 was fed upon four times, and 1 was fed upon five times.

Two volunteers developed fever, their histories being as follows :—

Volunteer Ram Das, aged 9, *male.*—On August 22 three flies which had originally fed on sandfly fever cases in Landikotal between August 13 and 16 were fed upon the volunteer. One of the flies took only a partial feed. This fly was again fed on the volunteer on the succeeding day.

On August 25 the volunteer developed fever which lasted for three days. Unfortunately, the boy lived in a village and did not report sick until the third day so that no record of his temperature was made. When seen on August 27 the fever was subsiding and the temperature was normal on the morning of August 28. On the 27th the patient's face was flushed, the eyes were suffused and he complained of pains all over the body and headache. The pulse rate was slow, eighty per minute. No coryza, cough or

any other symptoms which could account for the fever were present at any time. We have no doubt in our minds that this was a genuine case of sandfly fever transmitted by the bites of sandflies fed at Landikotal six to nine days previously on sandfly fever cases. It is unfortunate that owing to the non-reporting of the illness the temperature was not recorded.

Volunteer Kimla, aged 11, *male.*—On September 21 one fly which had originally fed on a sandfly fever case in Landikotal on September 16 was fed upon the volunteer. The feed was partial. On September 22, 23, and 24 three, two and two flies respectively of the same batch were fed; all these feeds were partial.

On October 5, ten days after the last feed, the volunteer complained of fever. The fever lasted for three days. There was complaint of pain behind the eyes, which were strongly injected, pains all over the body and headache. The pulse rate was markedly slow considering the degree of fever and the age of the patient, being 80 per minute. Chart 2 shows the progress of the fever in this case.

If this case was a genuine one of sandfly fever the incubation period was longer than usual and for this reason we make the diagnosis with reserve.

(4) *The flies do not become infective until seven to ten days after their meal on a fever case.*

In the two cases of fever recorded by us above the flies may be said to have become infective between the minimum of six days and the maximum of eight days.

(5) *The incubation period varies between three and a half and seven days.*

In the case of fevers following feeds by infected sandflies the incubation period varied in the two cases recorded by us between minima and maxima of three days and ten days. In our series of inoculation experiments the minimum and maximum incubation periods for typical cases of the fever, as measured by the interval elapsing between the time of inoculation and the first onset of fever, were three and six days, the average time for the seven positive typical cases being 4·4 days. In one of the two modified attacks the incubation period was three days and in the other five days.

(6) *The virus retains its infectivity for a week* in vitro.

In all our experiments we endeavoured to use the bloods sent from Peshawar as soon as possible after receipt as we were not, at the time, especially concerned to see how long the virus survived *in vitro*, but rather to utilize the blood while the virus was still alive.

In one case, however, 10 cubic centimetres of the filtrate from a L13 Chamberland candle from a mixture of specimens of citrated whole blood and citrated-glycerinated blood of a sandfly fever case, kept in the ice-chest for fourteen days, was inoculated into a monkey and appeared to be virulent. This experiment is dealt with later in the section dealing with animal experiments.

(*To be continued.*)

SOME LABOUR-SAVING DEVICES AND METHODS OF ECONOMY.

By Major E. W. WADE, D.S.O.,
Royal Army Medical Corps.

During a varied career in the Corps I have been struck on many occasions by the large amount of research work that has been done on many branches of life as it affects the Army. One of these researches in particular was the investigation into the energy expenditure of the soldier under various conditions, and another, if I remember correctly, was an article on the load carried by the soldier. Much time, thought and energy, has been expended in devising a new pack and a more suitable Service dress uniform for manœuvres and active service. In this short article I should like to put forward a few suggestions as to how time energy, and possibly a few pounds sterling as well as pounds avoirdupois may be saved annually!

I do not pretend that the ideas are new or that this article is complete; it is merely written in order that the suggestions may be considered, criticized, torn to pieces, or accepted, if finally thought to be worthy of adoption.

Everyone knows that the strength of the Army has been reduced since 1914, but everyone may not realize perhaps how great this reduction has been. The strength of the Army in 1914 was 244,396, whereas in 1933 it was only 191,171; the figures in each case are for British troops only. Now it follows that if an Army reduced by 53,225 is to be as efficient and useful when required, as the 1914 Army was, every possible man in it must be trained to the hilt in his respective branch, and as few men as possible should be permanently employed, particularly, on what I call "housemaids' duties," such as scrubbing floors, tables, forms, bedside tables, and polishing brass door handles, electric light switch covers, etc. This work is incidental, though at present necessary, to the health and well-being of all personnel; but I maintain it is not what the men join the Army for, nor the reason that an Army is maintained. The more this purely domestic work is abolished by substituting other articles and appliances, the more men are liberated for the essential military duties of the respective branches to which they belong. The fewer "housemaids" and the more soldiers we have in the Army, the more efficient that Army should be.

The following appear to be ways in which a considerable number of men and much time and energy can be saved daily for far more useful purposes.

(1) Abolish all brass door handles, finger plates, taps, electric light

switch covers, brass flushing pipes in urinals, etc., in barracks, hospitals, reception stations and wherever else they exist, and replace the taps and flushing pipes with chromium-plated ones and the other articles mentioned by substitutes that do not require polishing. In certain cookhouses the walls are adorned with highly polished baking dishes covers, and ladles, etc. I would abolish these altogether. They are so polished that they are obviously kept for, and produced at, inspections only. Sometimes the articles in actual use in these units are exactly the reverse in appearance of those produced at inspections. The polishing of all the articles mentioned in this paragraph employs a number of men for several hours daily in all units. Surely these men could be much better and more usefully employed than spilling metal polish on to metal articles, and rubbing it off again.

(2) Stain all windsor chairs, forms, floors, etc., in barrack rooms, dining halls, etc., and all bedside tables in hospitals and reception stations. At present one or more times a week all these articles have to be carried outside and very often down one or more flights of stairs to ground level, where they are scrubbed. When dry they have to be all carried back to their normal situations. The fact that these articles were always scrubbed and both surfaces had to be white in the past, when there were plenty of men to do the work, does not appear to me to be sufficient reason for continuing this useless expenditure of energy, which produces nothing in the end but a white wooden article which in a few days requires scrubbing again. A stained article can be quickly and easily polished *in situ* in half the time it takes to scrub, and looks just as smart. After all, the furniture in a normal house is stained and polished, not scrubbed, and all that is required is a readjustment of ideas.

(3) Stain all tables in barrack rooms, lecture rooms, offices, in fact all except those in the dining rooms. All that is required is an arrangement whereby the Barrack Department will stock stained and unstained tables, so that the respective article can be appropriately exchanged when damaged or worn out. This would save the time and energy at present wasted by several men in each unit daily.

(4) If the new large dining rooms at present being constructed throughout the country were built with the following slight alterations and one or two additional implements provided, a further saving of the triad, men, time and energy, could be effected. (*a*) The floors instead of being dead level should have a *slight* central camber falling away on each side to a runnel; (*b*) the lower three feet of the walls should be tiled or treated with some impervious material; (*c*) a tap and hose should be provided at one end; (*d*) four squeegees should be provided per room. Four men per battalion could then with their trouser legs rolled up and in bare feet, easily squeegee the floor in the same way that sailors swab decks. At present it takes approximately twelve "housemaids" per battalion on their hands and knees the whole morning to scrub these floors. The amount of water used would be no more with a hose than at present, and the floor would dry

more quickly after squeegeeing than with the present method. This would liberate twelve men per battalion for their essential military duties.

(5) If these same combined dining hall-cookhouse units were provided with dumb waiters on a scale of one per company, more men would be freed for military duties. At present approximately twelve men carry all the crockery in their hands from the tables to a series of shelves in the servery. From these shelves the crockery is transferred by more men to the washing-up machine, electric or otherwise as the case may be. When cleaned the reverse process takes place. The dumb waiter should be about the size of the present six-foot soldiers' table and have two or three tiers and be mounted on rubber-covered wheels. The shelves between the dining room and washing-up machine should be abolished so that the crockery can be trolleyed direct from the dining tables to the machine; if this were done the first dumb waiter load would be cleaned and out of the way almost before the second got there, and certainly before the last arrived.

(6) If all knives, forks and spoons on charge to military hospitals for issue to patients on admission were stamped HP, and if each knife, fork and spoon were numbered from 1 onwards and issued in sets, and a note of the set issued made on the pack store note, a great deal of loss of hospital property would be saved, and also a great deal of time in making out the personal charge claim. For instance if a patient were issued with set 5 (i.e. knife 5, fork 5, and spoon 5) and he handed in knife 5, fork 5 and spoon 3, he would be charged with the loss of spoon 5 unless he could find it, and also could possibly be charged with being in unlawful possession of spoon 3 which would be returned to the correct patient. This may sound cumbersome on paper, but it has been proved to work well in practice once the usual objections from the ward staffs to the introduction of anything new have been overcome, and it is understood by all that whether they like it or not the scheme has come to stay. The other way of getting over the difficulty is to have a special hospital pattern of cutlery, but this would be more expensive initially, though easier to work finally.

(7) Refuse, as is generally known, has a high thermic value, and in peace is usually placed in refuse bins and removed by the Municipal Authorities. There is always a shortage of fuel in all units. All refuse should be burnt, and the incombustible material raked out at the bottom of the fire. This would ease the shortage of fuel and greatly decrease the bulk that has to be removed by the Municipal Authorities. This should only consist of incombustible ashes, tins and bottles, all other refuse from barrack rooms, institutes, offices, kitchens, messes, married quarters, etc., being burnt in the single men's bath house fire.

(8) Surely it is also time that we reviewed our ideas concerning the disinfection of buildings. Here I shall have to digress slightly in order to make my meaning clear to those who may not be prepared at present to accept such modern ideas as I am about to express.

Well, then, let us recall to mind: (*a*) the time and care the surgeon and his theatre staff consider it absolutely necessary to spend on sterilizing their hands, the instruments, the patients' skin, and the dressings, etc., used daily, and also the way they cover themselves with gowns, caps, masks, boots, gloves, and the patient with sterilized towels; (*b*) the fact that an operation theatre is never disinfected with formalin or any other form of gaseous disinfectant after a septic case has been operated on. We can all remember occasions when a large collection of pus under pressure has been incised, and a considerable amount has poured down the surgeon's gown, or on to the floor of the theatre. All that is done is that the gowns, etc., are washed and steam disinfected, the rubber aprons and gloves scrubbed and disinfected, and the floor washed; (*c*) the fact that most of the infectious diseases in families, except cerebrospinal meningitis, diphtheria, smallpox and scarlet fever are treated in quarters, and that disinfection is never carried out until the first or subsequent cases occurring consecutively have recovered. The damage has been done, one or more persons in the family have recovered, and the remainder have resisted infection for the time. It is maintained, therefore, that by continuing to disinfect buildings with gaseous disinfectants or spraying with liquid ones, we are doing not the slightest good and merely pandering to public opinion.

How often does one disinfect a room after a case of, say, measles, and in a few weeks the disinfection has to be done over again after, shall we say, chickenpox. Remember also the duration of an average attack of whooping cough in a family of three or four children. Surely the same result would be obtained by: (i) Steam disinfecting all articles that will not be damaged by this process; (ii) opening all doors and windows so as to thoroughly ventilate the building; (iii) scrubbing the immediate surroundings of the bed; (iv) educating by propaganda the general public out of the existing mediæval ideas which are a relic of the measures taken after the Great Plague when sulphur burning was the fashion.

This would save the time at present spent in sealing up all doors, windows, etc., the men employed in doing this, the cost of the materials used, and the cost of redecorating afterwards. The sealing up also is always done by one or more privates and the care with which it is done varies very considerably. The present method would appear in 90 per cent of cases pure "eye wash."

(9) Lastly, in so far as this article is concerned there is an enormous amount of time, energy, paper and postage wasted in producing the "multiplicate" copies of the numerous returns required. Are all these copies and *all* these returns really essential? Could not the question be investigated at length by a Committee of Royal Army Medical Corps officers? Officers of the Corps in general outside Headquarter offices remark on the mass of clerical work. As one company officer puts it, "A company officer at present has so many returns and so much frenzied finance that he hasn't time or energy to get on with the training." He has either to spend his

days checking things, paying out, and answering correspondence, or to leave all that to his clerks and "just sign on the dotted line" and get out and see his men, train them and generally run the company. The fewer returns that have to be rendered, the greater the chance of their being accurate. The more accurate they are the less observations arise. At present the vicious circle is working the other way, too much correspondence leads to rush, and causes inaccuracies, necessity for reminders and masses of observations, hence more "snowing under."

I suggest as an example, two existing returns that could be combined, namely Corps Form 22 prepared in quadruplicate, and Corps Form 1 prepared in quintuplicate. Individually these contain very little information special to the form, but mostly the same information differently arranged.

Another instance is Army Form A. 31 and Army Form A. 31A. The columns in these forms are so narrow that the figures on each of the three copies required have to be entered in manuscript. A separate return is also required for different categories of patients and each has to be prepared in triplicate in manuscript. One copy is forwarded direct to the War Office, one copy is sent to the A.D.M.S. who forwards it to the D.D.M.S. for perusal and return, the other copy is kept as an office copy. The clerks in the three higher offices extract the figures into books for embodiment in the corresponding Annual Health Report. Surely to employ these clerks in different offices doing exactly the same work each month is a waste of time and energy. There must be some better method if only we could get together and discuss it. Writing is too slow a way to find a solution, a Conference with all the aspects of Corps duties represented and plenty of time to discuss them is the only way. Could not many returns be combined and/or rendered far less often by the use of amendment slips periodically.

I have written this article solely with the idea of producing suggestions, so that we may be quite satisfied, as a Corps, that there is nothing that can be improved; that all possible waste of time and energy on "housemaids'" duties in the Army may be abolished; that there is no unnecessary return called for, or unnecessary copies required. There are officers in various branches of the Corps with far more experience than I have of those branches and from *all* our ideas and suggestions, something of value might arise.

A HILL STRETCHER.

By Major T. O. THOMPSON,
Royal Army Medical Corps.

This stretcher was devised for use in hill work on the frontier, and particularly for getting casualties down from pickets. Four of these stretchers were in use for a considerable time in ordinary peace time column work and during training, but this pattern was not taken up officially as another stretcher was on trial at that time.

The present type, however, appeared to be very effective for the work

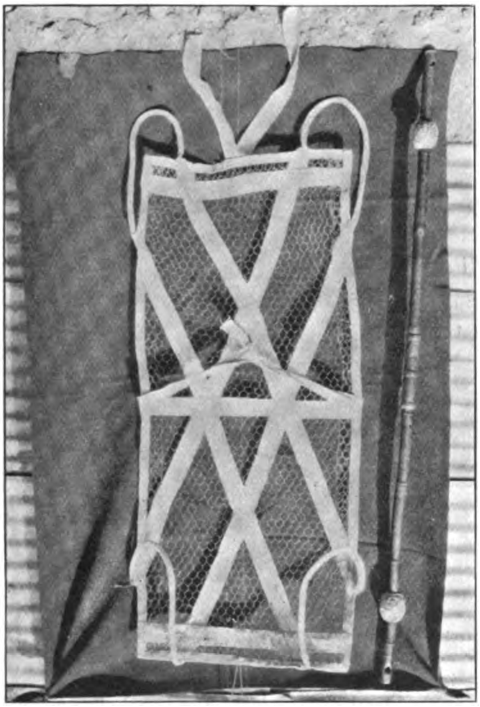


Fig. 1.—The Stretcher.

for which it was designed. A description is therefore given in the hope that it may prove of use to others at some future time.

As originally designed the stretcher consisted of a sheet of galvanized wire netting, supported by a band of cotton webbing. The cotton webbing was extended into loops at the corners and formed the carrying loops. These loops were hitched over a carrying pole and were kept in place by stops on the carrying pole.

The patient is slung as though in a hammock, and is tied in so that he cannot fall out. The stretcher and patient can be carried by two men.

Wire netting was used as it was thought that it would give a greater rigidity for carrying fractures of the lower limbs. The rigidity was obtained, but it was found that after some months the wire netting became kinked and wrinkled up out of shape. The advantage of the wire netting was its extreme lightness and cheapness.

More recently a sheet of canvas has been used to replace the wire netting and a satisfactory result has been obtained. The description now

Fig. 2.—Pack-carriage.

given, however, applies mainly to the stretcher as originally devised and used.

The whole stretcher can be rolled up and carried by one man (fig. 2) either slung on the shoulder or in the pack position over the normal equipment. This allows complete freedom of the hands for hill climbing or in difficult bush country.

The pole is jointed and in the improvised model it was the ridge pole of an 80-lb. tent. The weight of the improvised article is 8¾ lb.; the probable weight of standard stretchers made with canvas and suitable poles would be about 10-11 lb.

The cost of the stretcher made up at Razmak in the bazaar and

exclusive of pole was Rs. 5/4/-. The cost of a single canvas model made by Ordnance would be Rs. 13/-.

METHOD OF MAKING UP (*see* fig. 1).

(1) A sheet of light strong canvas 6 feet 2 inches long and 3 feet broad is required. The ends and sides are turned and sewn over a couple of inches deep.

(2) Navaree cotton webbing is sewn doubled over the edge all round, and a strip is sewn on both sides over the turned over ends.

(3) Webbing is also sewn diagonally across the under side with free portions to form handles.

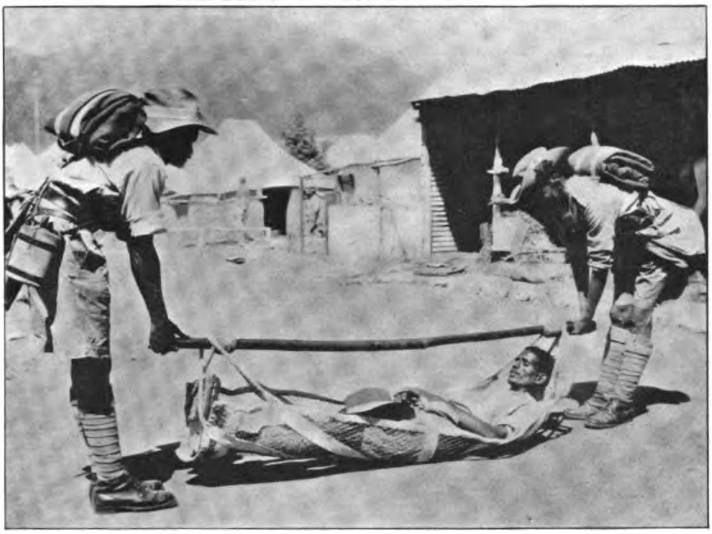


FIG. 3.—Ready to Lift.

(4) Two tags are formed by a piece of webbing sewn across the middle of the canvas; (i) the loop tag is 18 inches long and has a 3-inch loop at one end; (ii) the plain tag is 30 inches long. These are used for tying the patient into the stretcher, and as a sling for carrying the stretcher in the rolled position.

(5) A double tag ("the end tags"), 18 inches long, is sewn on to the middle of one end. This is used for tying up the stretcher when rolled.

(6) For the pole the ridge pole of the 80-pound tent is 8 inches too short for comfortable carrying, and a better one has been made from a larger tent pole, but this is heavier. The correct pole is made of one female bamboo pole about 1½ inches in section and 7 feet long. This is cut into two portions: (*a*) 3 feet 4 inches, (*b*) 3 feet 8 inches. On to piece (*a*) a light iron socket 8 inches long with a 4-inch hold for (*b*) is fixed. Both

are now 3 feet 8 inches long for carrying. Two stops, consisting of Turks' heads (such as are used on tent poles) are fixed 9½ inches from the free ends of the pole.

Method of Use.

For field ambulance work a squad consists of three men; one, with surgical haversack and water-bottle, commands the squad, assists in steadying the patient and takes his turn at carrying.

The stretcher is unrolled, laid flat and the patient laid on it.

The two halves of the pole are slipped through the sling handles, taking care they are not twisted, and are then joined together by means of the socket.

Fig. 4.—Lifted.

The two handles at each end must be on the distal side of the stops, so that the canvas is kept stretched out. The inward drag of the handles prevents the poles from slipping apart.

Working with three bearers, Nos. 1 and 2 raise the stretcher and No. 3 ties the two middle tags round the patient; they should not be tied round the pole. The patient is thus securely held inside the slung canvas.

Bearer No. 3 can carry the patient's rifle and equipment if necessary.

Method of Rolling for Transport on the March.

The two halves of the pole are placed, with the stops at the same side, across the breadth of canvas at the end opposite the end tag. The canvas is then rolled round the poles and tied off by the end tags.

The sling handles and middle tags should be left free. The latter are

then passed between the poles at each end and the plain tag knotted through the looped tag forming a sling for carrying.

The stretcher now forms a roll 2 feet 9 inches long with the poles, 3 feet 8 inches long, jutting out at either end (*see* fig. 2).

METHOD OF CARRIAGE.

The poles must be carried so that ends with the stops are uppermost to prevent them falling out. (*a*) When carried as a pack, the webbing loop (sling handle) at the upper side should be pulled well out; one arm is passed through this free sling handle nearest the stops and the other arm

FIG. 5.—On a Slope.

through the loop formed by the two middle tags. The whole roll can be carried in this manner as a pack over the normal equipment (see fig. 2). This allows free use of legs and arms for hill-side climbing. (*b*) When carried in the sling position one arm is slipped through the loop of the middle tags and the whole slung over the shoulder. This is the most comfortable position for actual marching.

This stretcher has been tried out on khuds (steep hill sides) in the Razmak area, a section of four stretcher squads being actually in use in the field ambulance.

It is less wearying to carry when rolled up than the ordinary stretcher. The squad can easily reach any picket and move with the fighting unit without trouble. Only two men are actually needed for any normal carry down a khud.

It was found that a "hill stretcher squad" could evacuate two patients from a difficult picket in just the time taken for one patient by an ordinary squad of four men with the Indian Pattern Mark I stretcher.

The patient is securely held with no danger of falling off on the steepest slopes. A man of 6 feet 3 inches has been carried down from a picket by this means.

The stretcher has definite disadvantages, but it is intended for hill use only and not for long carries on the flat. It sways considerably when men are marching with a load on the flat and the weight for two men is also excessive for long carries on the flat.

The rear man has some difficulty in seeing the ground he has to walk on, but this difficulty is no greater than with any other form of stretcher.

It is hoped that this form of stretcher may prove of use to those concerned with the removal of casualties in difficult frontier country at some future time.

REVIEW OF FEVERS OF THE TYPHUS GROUP (VECTOR UNKNOWN) OCCURRING AT AHMEDNAGAR DURING 1933.

By Captain BASIL BLEWITT,
Royal Army Medical Corps.

(*Continued from p.* 319).

General Remarks on the Symptomatology.

1. *Headache* is a constant symptom, a feature of the prodromal stage and of the onset of the fever. It is described as a dull ache, sub-occipital and intermittent at first, radiating to the front, more particularly to the back of the eyes, and is associated with a varying degree of photophobia and conjunctival congestion; it gradually becomes constant and usually persists until the end of the fastigium.

2. *Myalgia* follows upon the headache and is described as a dull rheumatic ache especially of the adductor muscles of the thigh, the psoas, and the erector spinæ group in the back.

3. *Joint pains* are generally polyarticular, but may commence in one joint, specially the knee-joint. Whichever the mode of onset they rapidly become generalized, particularly in the joints of the lower extremities. The pain is described as a dull ache with occasionally subacute exacerbations. The pains usually persist until the stage of defervescence.

4. *Vomiting* is unusual, but occurs frequently associated with a rigor at the onset of the fever. There is nothing noteworthy in its character.

5. *Rigors* are usual and appear to initiate the onset and may be associated with vomiting as indicated above.

The earliest clinical picture is therefore one of headache, generally suboccipital, radiating to the back of the eyes, associated with a low grade temperature, though a patient may be apyrexial. Such a picture occurring within the seasonal limits should suggest an incipient fever of the typhus group even when there is no history of having been exposed to infection or of having been bitten by any insect. Should these symptoms increase and joint pains and rigors occur, the case might reasonably be treated as the onset of a fever of the typhus group and investigations commenced with this in view. In this way clinical data of the earliest stage would be secured and the possibility of a transient early septicæmia investigated. Lack of experience of the early clinical picture has resulted, at least in this station, in missing during the earliest stages blood and urinary investigations, these being usually left until the eruption made the diagnosis clear.

It is therefore suggested that all P.U.O. cases occurring within the seasonal limits of these fevers, with blood slides negative to malaria, and the clinical picture as above indicated, should be regarded as possible fevers of

the typhus group and clinical investigations be started from the commencement with this in view.

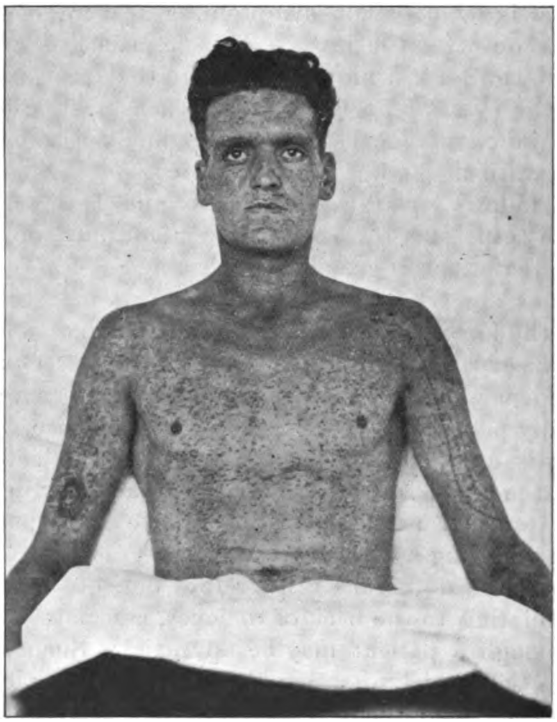
The Rash

appears on the third to the fifth day of the fever, usually on the third. Variations have occurred, the rash appearing on the calculated second day in one case and on the ninth day in another.

The rash consists of two elements :—

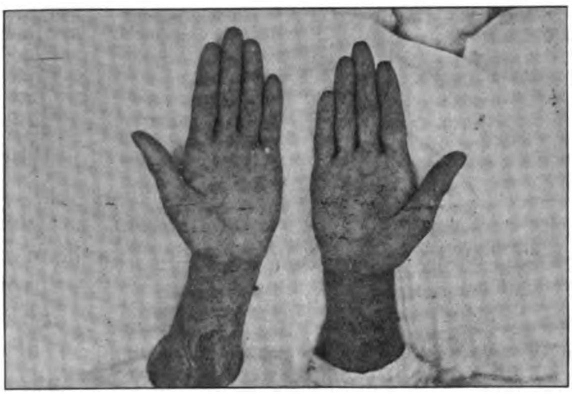
(*a*) A papulo-maculo roseolar element.

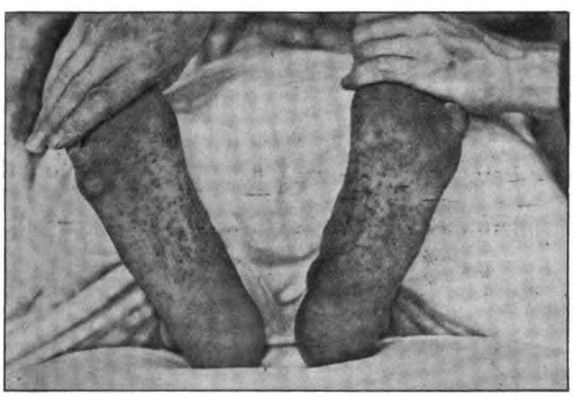
(*b*) A petechial element.



The eruption appears on the third day and may be preceded by a transitory rise of temperature. Usually it commences on the front of the chest and abdomen as faint circumscribed roseolar areas hardly noticeable with a scanty distribution, and its appearance may be entirely missed. A few spots can generally be detected along the inner aspect of the forearms and legs. The eruption fades on pressure, does not itch, and the patient is unaware of its existence. Within twenty-four hours it is well defined and has assumed its characteristic appearance, a profuse discrete mulberry coloured papulo-macular eruption. Though generalized in distribution it is not apparent usually at this early stage on the palms of the hands and on the soles of the feet and may not be so for another two

to three days when the petechial eruption begins to appear. The petechial eruption usually appears about the sixth or seventh day of the disease. It consists of minute hæmorrhagic areas not unlike lice bites; indeed at first, before it has become profuse, the patient may complain that he has been bitten by some insects. These petechiæ are interspersed among the mulberry eruption and are a feature of the latter stages of the disease.





The delay in the appearance of the eruption on the palms of the hands and on the soles of the feet is considered to be due to the character of the primary eruption, which is such as not to afford a contrast in these areas where callosities, thickening of the skin, and a normal tendency to a type of mottling tend to obscure the primary eruption, or at any rate do not afford the same contrast as in other parts of the body, with the result that presence of the rash is either missed or a matter of doubt. This idea is borne out in a case occurring in a young child where the difference in the skin over these areas as compared with the rest of the body does not form the same contrast as in the adult. In this case the rash definitely

began on the soles of the feet at 2 p.m., and rapidly advancing up the legs it was fully generalized over the body by 6 p.m. It is considered therefore that the eruption appears on the palms and on the soles of the feet about the third day and that the frequent apparent delay is due to the difficulty of appreciating its presence in these areas at this early stage. About the sixth or seventh day the primary element of the eruption has deepened in colour and has become more defined and the secondary element, which is well defined from its onset, has appeared; the rash therefore becomes more easily detected in these areas and may lead to the assumption that this is a delayed extension.

The rash is present on the face and forehead in all cases, the degree varying apparently with the severity of the fever: in some cases, with a high fever and a profuse eruption, the facial involvement has been a marked feature; mild attacks with a scanty rash have a very slight facial involvement. The scalp would appear not to be involved. It has been stated that the pubic area usually escapes but this has not been noted in cases occurring at this station where the rash has invariably involved this area. The eruption reaches its zenith about the tenth day of the disease and remains more or less in a stationary condition until about a week after the fever has subsided and then gradually begins to fade, but can be detected for a considerable time after convalescence, usually for two to three months. In milder cases, however, the rash begins to fade about the twelfth or thirteenth day of the disease, and in these cases it has usually disappeared in about three to four weeks after the fall in temperature. It tends to fade first on the face and then on the trunk; the last regions to remain involved are the upper and lower extremities, especially the inner flexor surfaces where it persists long after all other signs of the rash have disappeared.

The photographs illustrating the rash were taken on the tenth day of the disease and demonstrate very well its character and distribution, especially on the face, palms of the hands and soles of the feet.

Treatment.

There is little noteworthy in the treatment of these fevers adopted in this station. The ordinary general principles for the treatment and nursing of fever have been observed.

Of drugs the salicylate group, the sodium salt and acid acetyl salicylic, have been given for their analgesic action when the symptoms warranted such a course; their use is of definite value for the relief of joint pains, myalgia and headache, though certain cases have not responded. It was found that to procure the desired results the sodium salt should be given in massive doses (30 grains t.d.s. combined with the usual amount of sodium bicarbonate); given in these amounts relief from the joint pains and myalgia is secured within three to four days. Acid acetyl salicylic in

5-grain doses, with caffeine and phenacetin, has been found to give immediate relief to the headache.

No attempt was made to alter the course of the pyrexia unless it was of such degree as to cause anxiety or marked discomfort to the patient, in which case sponging was resorted to, invariably with excellent results. It is noteworthy that the salicylates do not appear to exercise an antipyretic action in these fevers, which is considered an advantage.

Specific treatment.—The use of serum from patients and convalescent cases was considered, but several factors made its use either impossible or undesirable, as cases did not always coincide as regards time; certain patients were unwilling to give blood at all when cases did coincide and serum was available. A positive Wassermann negatived its use, when uncertainty existed as to whether it was incidental to the fever or the result of specific infection.

It is proposed, however, in the next series of cases to secure very early Wassermann results, and if these are negative in the earliest stages to use the serum even if later Wassermann reactions are positive.

Diet.—As regards diet there appears to be no advantage in restricting the patient's diet, and cases have always been given as much food as they asked for, generally they have had a light diet from the start. Where the diet has been other than full no attempt was made to secure a daily evacuation of the bowels, but in all cases on a full diet calomel, 1½ grains after mid-day (in three half-grain doses), followed by a mild saline aperient in the morning, has been given as a routine.

Clinical Investigations.

I. *Blood Picture.*—Approximately 50 per cent of the cases have a leucocytosis of 10,000 or over early in the disease—the increase being of the polymorphonuclear leucocytes. The remaining 50 per cent have a normal or slightly raised white cell count, though a leucopenia was recorded in one case. Other than this the blood picture revealed little of interest.

II. *Blood Cultures.*—These were carried out at given intervals during the fever, the media used being glucose citrate broth and blood agar slopes. Tests on blood taken from patients were made on blood agar slopes, but the results of blood cultures were invariably unsuccessful. Blood aspirated from a tick found on cattle was placed on blood agar slopes, but the results were negative.

III. *The Widal Reaction.*—A rise in the agglutinins for *B. typhosus*, *B. paratyphosus* A and *B. paratyphosus* B was noted in certain cases, such as in Case No. 8, in which the following results were obtained.

	B.T.	Para. A.	Para. B.
1st week (numbers are presumably agglutinin units)	7	13	11
2nd week	11	18	25
3rd week	31	10	21

In other cases a rise in the agglutinins was not a feature.

RESULTS OF LABORATORY EXAMINATIONS OF FEVERS OF THE TYPHUS GROUP (VECTOR UNKNOWN) DURING 1933.

Case No.	Blood tests	WEEKS— 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	W.F.	—		+++	++	No further tests until December, 1933--All negative																	
	W.K.	0	—																				
	B.C.	—	S	S	0																		
	W.B.C	7,130	0	0	0																		
2	W.F.	00	0	+++	+++																		
	W.K.	0	0	0	+																		
	B.C.	0	S	S	0	,,	,,	,,	,,		,,	,,											
	W.B.C.	7,808	0	0	0																		
3	W.F.	—	+	+	0											—							—
	W.K.	00	0	0	0											-							—
	B.C,	C	S	0	0																		
	W.B.C.	7,800	0	0	0																		
4	W.F.	0	--	++	—																		—
	W.K.	0	0	0	4																		—
	B.C.	S	S	0	0																		
	W.B.C.	6,800	0	0	0																		
5	W.F.	0	—	—	0	Left the Station																	
	W.K.	0	0	0	0																		
	B.C.	S	S	0	0																		
	W.B.C.	8,000	0	0	0																		
6	W.F.	—	+	++	0	Left the Station																	
	W.K.	0	0	0	0																		
	B.C.	C	C	0	0																		
	W.B.C	10,500	0	0	0																		
7	W.F.	0	—	—	0	Unwilling to have further tests carried out																	
	W·K.	0	0	0	0																		
	B.C.	0	C	0	0																		
	W.B.C.	11,400	0	0	0																		

8	W.F.	—	—	++	+	++	0	0	+	0	—
	W.K.	—	—	+	+	—	0	0	—	0	—
	B.C.	S	C	0	0	0	0	0	0	0	0
	W.B.C.	8,500	9,385	0	0	0	0	0	0	0	0
9	W.F.	—	+	+++	+++	0	0	++	Left India. Tour expired		
	W.K.	0	0	++	N.I.	0	0	—			
	B.C.	S	0	0	0	0	0	0			
	W.B.C.	18,000	0	0	0	0	0	0			
10	W.F.	—	+	++	+	0	0	0	—	Left India. Tour expired	
	W.K.	—	—	—	—	0	0	0	—		
	B.C.	C	0	0	0	0	0	0	0		
	W.B.C.	10,700	0	0	0	0	0	0	0		
11	W.F.	—	+	+++	+++	++	0	0	+	+	
	W.K.	0	—	0	0	—	0	0	—	—	
	B.C.	S	C	0	0	0	0	0	0	0	
	W.B.C.	20,000	0	0	0	0	0	0	0	0	
12	W.F.	0	—	+++	++	++	0	0	+	0	—
	W.K.	0	0	++	++	N.I.	0	0	N.I.	0	+
	B.C.	S	0	0	0	0	0	0	0	0	0
	W.B.C.	0	8,000	0	0	0	0	0	0	0	0
13	W.F.	0	+	+++	Left for United Kingdom						
	W.K.	—	—	0							
	B.C.	S	0	0							
	W.B.C.	15,250	0	0							

KEY—

W.F.: Weil Felix. + = Agglutination titre 125-250
++ = " " 250-500
+++ = " " 500 and over

W.K.: Wassermann and Kahn—Positive: +
Strong Positive: ++
Negative incomplete: N.I.

B.C.: Blood culture: S—Sterile
C—Contaminated

W.B.C.: Leucocyte Count.

Note.—0 = Specimen not taken
— = Specimen taken, but results negative.

IV. *Wassermann and Kahn Reactions.*—The Wassermann and Kahn reactions were found to be invariably negative for the first fourteen days; 75 per cent were positive in the third week and 80 per cent in the fourth; by the sixth week 100 per cent were negative. It would appear, therefore, that unless the Wassermann and Kahn reactions are taken during the third and fourth weeks an erroneous impression would be formed as to the percentage of cases with positive reactions. The period when results may be expected is short and negative results in the first two weeks might discourage one from carrying on with further tests.

V. *The Weil-Felix Reaction.*—Serum from normal healthy people was found to give titres of 1 : 50, and to facilitate plotting the agglutination curve in these fevers a base line diagnostic titre of 1 : 125 was taken, special importance being attached, however, to a rising curve. It is of interest that of the twenty-one cases of these fevers which have occurred at this Station only two had agglutinating titres under 1 : 125 which failed to rise during the course of the disease. The strains of *Proteus X* bacilli used were *Proteus X* Kingsbury, *Proteus X*2 and *Proteus X*19, and it was noted that *X*19 usually gave the earliest positive results and the highest, and the most prolonged results; *X*2 gave the next best results.

It was found that the Weil-Felix reaction was invariably negative during the first week, 60 per cent of the cases were positive in the second week and 100 per cent in the third week.

The curve rises rapidly in the second week, and by the third week has risen from a titre of between 1 : 125 to 1 : 250 in the second week to 1 : 500 and over; 40 per cent of the cases, however, remain negative until the third week. The height of the curve is maintained until somewhere between the fifth and sixth weeks, when it gradually commences to fall and by the twelfth week is well below the base line titre. From the standpoint of serum therapy the optimum period for the collection of serum is the third to the fifth week, assuming that the titre percentage indirectly indicates the antitoxic properties of the serum. A further reason for the collection of serum at this time is that it permits of Wassermann and Kahn tests during the first two weeks from which an opinion could be formed as to the advisability of giving serum without the fear of introducing syphilitic infection.

Conclusions.

(I) The rate incidence of these typhus-like fevers caused by an unknown vector is on the increase, and their importance from the Army medical standpoint cannot be overestimated in view of the prolonged period during which the soldier is incapacitated from any duties, with the possibility of his never becoming fit for general service and his ultimate discharge on medical grounds.

(II) Apart from the greater exposure to infection in the cold weather, the evidence is definitely in favour of a seasonal incidence, suggesting a seasonal infectivity of the vector.

(III) The evidence is strongly in favour of the tick as the vector, human contact with the vector occurring when circumstances favour an unusually close proximity to tick-infested cattle, which occurs: (1) Within cantonments during and after the rains when the sale of grazing rights, both public and private, occurs; and (2) out of cantonments on manœuvres or during private parties, during the period of seasonal infectivity, when camps are pitched on sites which attract herds of cattle and human beings.

(IV) An immunity would appear to exist among natives in an endemic area, as inquiries in the native villages and from the mission doctors in the area failed to elicit any history of such fevers.

(V) An incubation period of sixteen days on the average exists, followed by a prodromal phase of twenty-four to forty-eight hours.

(VI) The fever is characterized by: (1) Pyrexia of a swinging type lasting sixteen days on the average; (2) a generalized rash consisting of two elements, roseolar papulo-macules appearing on the third or fourth day and petechiæ appearing on the sixth or seventh day, both elements invading the palms of the hands and soles of the feet; (3) dengue fever symptoms, i.e. joint pains and myalgia, occur; (4) positive Weil-Felix reactions commencing either in the second or third week, and persisting for eight or nine weeks; (5) positive Wassermann reaction in 75 per cent of the cases in the third week, and 80 per cent in the fourth; by the sixth week all are negative.

No attempt has been made to deal with the bibliography of this subject, as this has already been excellently reviewed by Major J. Biggam, R.A.M.C., in the August issue of the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, 1932.

I am indebted to Lieutenant-Colonel C. J. Wyatt, R.A.M.C., for permission to forward the reports on these cases, and to Assistant Surgeons Ray and D'Mello for much of the unseen spadework.

Editorial.

DISEASES OF CURRENT INTEREST.

Influenza.

The last decade has seen a considerable volume of research undertaken on the filtrable viruses. As a result a number of infections of hitherto unsolved ætiology have been placed in this category. One of the most important additions to this group of diseases is influenza. The significance of this observation does not require emphasis. The widespread nature of the disease, its frequent manifestations in epidemic form and its often severe and fatal course have so far defied all attempts at control. Hygienic measures, whilst possibly lessening the chance of infection, have not been successful in preventing its occurrence and recourse to some form of immunization would appear to be the only hopeful method of prevention.

The preliminary to any successful form of prophylactic inoculation is obviously the correct identification of the ætiological agent. For many years a visible micro-organism—*Hæmophilus influenzæ*, owing to its constant association with the condition, has been accepted as the cause of the infection. For this reason attempts have been made to confer immunity by the employment of vaccines which include this organism. The general consensus of opinion is that vaccine prophylaxis has failed to prevent infection although some observers have maintained that it reduced the occurrence of complications.

The work undertaken during the pandemic of 1918 and 1919 resulted in a change of opinion regarding the rôle played by the influenza bacillus and it was suggested that the real infective agent was a virus. Insufficient evidence was, however, available at the time to accept this contention. One of the difficulties encountered in this research was the insusceptibility of the usual laboratory animals to the disease, as the only satisfactory method of demonstrating the presence of the virus in filtered material from the lesions was the reproduction of the infection by animal inoculation.

Within the last year English workers (Andrewes, Laidlaw and Smith) have succeeded in infecting ferrets with a virus obtained from human cases of influenza, and also with a strain of swine influenza virus isolated in America (Shope). The use of ferrets was suggested by the employment of these animals in the research on distemper as they had been proved to be readily infected with the virus of this disease. Washings from the nose and throats of early cases of influenza were filtered through a membrane impermeable to bacteria, and ferrets were inoculated by the instillation

into the nostrils of a few drops of this filtered material. After a brief incubation period the ferret suffers from a diaphasic temperature response accompanied by symptoms of nasal catarrh. Within three or four days the animal recovers and is found to be solidly immune to subsequent inoculation. It has also been determined that the infectivity of the filtered material is neutralized by the addition to it of the serum of a ferret convalescent from the infection. Subcutaneous inoculation of the virus fails to transmit the infection, which fact demonstrates its selectivity for respiratory tract tissues.

Further work undertaken in America (Shope) with the swine influenza virus confirmed its infectivity for ferrets. In addition, by instilling the filtrate of infective material into the nostrils of etherized ferrets it was found possible to reproduce the disease in a more severe and frequently fatal form. Ferrets inoculated in this manner which had been killed, or died on the fourth or fifth day after inoculation, showed at autopsy the œdematous type of pneumonia so characteristic of fatal cases of the human infection. The relationship of the swine influenza virus to that of human origin formed a part of this study and it would appear that they are identical.

Continued research by English workers (Andrewes, Laidlaw and Smith) has shown that mice react to the virus of human and swine origin in a very similar manner to ferrets. A severe and frequently fatal disease can be conveyed to these rodents by nasal instillation of the virus, or by its inoculation directly into the lungs through the thoracic wall. An important observation made by these observers is that the virus alone can reproduce the infection, the presence of any bacterial agent being unnecessary. This fact would appear to controvert the contention of certain observers that the influenza bacillus is a necessary concomitant, in addition to the virus, in the reproduction of the disease. The determination that mice can be employed as test animals for the presence of the virus facilitates more extensive and further research.

It will be evident that an important advance has been made regarding influenza which affords hope that progress in the direction of some form of immunization will result. In this connection it will be obvious that the so-called "influenza vaccine," which includes the influenza bacillus in addition to various other organisms associated with catarrhal affections, cannot be expected to confer any protection against the disease.

Common Cold.

There are still many who believe that the incitant of a common cold is one or other of the usual bacteria found in the upper respiratory tract. This is apparent from the number of requests made to the Vaccine Department, Royal Army Medical College, for autogenous vaccines prepared from organisms isolated from nasopharyngeal swabs. That this view is incorrect was clearly demonstrated some years ago.

As far back as 1914 the hypothesis was advanced that the common cold could be attributed to a filter-passing virus rather than to any of the visible organisms found in the naso-pharynx. More extensive and more carefully controlled work in America (Dochez and his co-workers) has proved the accuracy of this contention. In research on this infection the usual difficulty of the insusceptibility of laboratory animals was encountered. The fact, however, that the chimpanzee suffered from a malady indistinguishable from the acute coryzæ of the human suggested that these anthropoid apes might be employed as suitable test animals for the presence of virus. Nasal washings from early cases of common cold were filtered; the filtrate, instilled into the nares of chimpanzees, produced, after the usual incubation period, the symptoms of a common cold. Serial passage from ape to ape resulted in the successful transmission of the virus.

The work of these observers repeated on human volunteers produced similar results. Experimental transmission was as successful as in the case of the chimpanzee. The virus has been cultivated by special methods, and in the fifteenth sub-culture has proved capable of producing the affection in two out of three volunteers. It is contended that the virus, in addition to increasing the susceptibility of the respiratory tract to the invasion of the usual visible pathogenic bacteria, actually enhances the virulence of these organisms. The studies of Long and his collaborators in America, which were subsequent to the work of Dochez, provided confirmation of his findings. This work, so striking from the meticulous care taken in all its controls, was carried out on human volunteers.

The intense infectivity of the common cold, the brief incubation period of the disease and the consequent reduplication of foci of infection, are the factors responsible for its widespread dissemination.

It can be concluded that inoculation against the common cold, whether by the use of stock or autogenous vaccines, cannot be relied upon to prevent the onset of this disabling infection, at most the prevention of complications may perhaps be effected. The indiscriminate use of vaccines as a preventive measure can only result in bringing vaccine prophylaxis, so valuable in the case of other infections, into disrepute.

Measles.

Although it has not yet been established definitely that the causative agent in measles belongs to the virus group of diseases, epidemiological evidence and experimental observations indicate this probability.

As is the case of the virus infections discussed above, there is difficulty in communicating this disease to the lower animals. It has, however, been claimed that a modified form of the infection has been produced in the monkey by inoculation with blood taken at the height of the disease, but apart from this none of the ordinary laboratory animals has so far been

proved susceptible, and consequently it has not been possible to prepare an immune serum.

Recovery from measles in man is followed by a solid immunity and second attacks are the exception. Serum obtained from measles convalescents, if given to susceptible individuals who are incubating the infection, has been shown to have marked protective properties. The serum may be given to contacts for two specific purposes: (1) To prevent completely the onset of an attack; or (2) to lessen the severity of the illness. Once the infection has declared itself the serum has no beneficial effect on the course of the disease.

Given as a prophylactic agent, i.e. before the fourth day after contact with a child with a rash, the serum yields complete, though transient, immunity. This is the procedure usually followed in the case of weakly children when the disease can be postponed to a later age. Should the disease develop in subsequent years the course of the illness may be less severe. Amelioration of the attack can be effected by giving the serum after the fourth day of contact, but before the sixth or seventh day.

The subsequent illness runs a milder course and may only be diagnosed with difficulty owing to its modification. Further, complications which account for the mortality of this disease are considerably reduced, and a permanent immunity is induced.

Anti-measles serum obtained from human convalescents can be purchased in limited quantities in the market. Notification of the fact that a supply of the serum, obtained from Army sources, is available on indent from the Vaccine Department, Royal Army Medical College, London, together with detailed instructions regarding dosage, etc., has already been circulated to Home Commands.

Where there is difficulty in obtaining the serum of measles convalescents, recourse may be made to the serum from healthy adults with a definite history of measles, after it has been subjected to the usual tests. The result is stated not to be so good as that which follows the use of convalescent serum.

Poliomyelitis.

Acute anterior poliomyelitis is a disease which chiefly affects children, though it may also occur in adults. The diagnosis in the early stages, i.e., the pre-paralytic stage, presents difficulties not only on account of the sporadic appearance of cases, but because the nerve lesions may be very diverse. As a rule there is little to guide one in differentiating cases in the pre-paralytic stage from cases of catarrh associated with general febrile symptoms. Lumbar puncture may yield valuable information, but this to a great extent is dependent upon the degree of meningeal involvement. The cerebrospinal fluid, on being withdrawn, is usually under moderately increased pressure, clear to the naked eye, but shows

by transmitted light a faint haziness or ground-glass appearance. The cell count may be normal or slightly increased. If there has been much involvement of the meninges the predominating cell in the very early stages is the polynuclear leucocyte, but later this type of cell is replaced by the lymphocyte. There is marked increase in the globulin content, but glucose and chlorides are present in normal amounts. No organisms can be detected and cultures are sterile.

Blood changes are usually definite and consist chiefly in a rise in the number of white cells. The total white count may be from 15,000 to 20,000 or more per cubic millimetre, the polynuclear leucocytes being raised to 15 to 20 per cent above the normal.

The causative agent is a filter-passing virus which experimentally can be transmitted to the monkey. Infective material from human cases can most readily be obtained from the brain and spinal cord where it is found in greatest concentration. On first inoculating the monkey with infective material from the lesions the virus may be of low virulence, but after several passages from monkey to monkey the virulence becomes greatly exalted and the virus can be demonstrated in other tissues. It has been found to be present in the Gasserian ganglion, and in the intervertebral and abdominal sympathetic ganglia. In addition it may be demonstrated in lymphatic tissue, especially the tonsil and mesenteric glands. It has also been shown to be present in the nasal mucous membrane and nasal secretion. Its presence has not been demonstrated, however, in the blood or cerebrospinal fluid. The virus behaves similarly to many of the other viruses in that it will remain viable in the desiccated state and in 50 per cent glycerol if kept at a low temperature for a considerable period of time. It will also resist the action of 1 per cent phenol for several hours.

The disease can be most readily transmitted to the monkey by the intracerebral or subdural route, but it can also be originated by injecting the virus into the sheath of a nerve or through the scarified nasal mucous membrane, or it can be conveyed by nasal insufflation. Subcutaneous and intraperitoneal methods of inoculation are also successful, but infection can only be brought about by the intravenous route if massive doses of infective material are injected.

The virus has been demonstrated in the nasal secretions of the monkey, not only during the period of active disease, but also for some months after apparent recovery. This is a point of importance and suggests the possibility of carriers in man, especially among abortive cases.

In view of the rapidity with which the flaccid paralysis develops, usually within forty-eight to seventy-two hours, and the fact that once the paralysis has appeared no beneficial results can be derived from the inoculation of immune serum, the main consideration is that anything that is likely to do good must be given at once. It is claimed by one group of workers that the administration of immune serum, if given in the pre-paralytic stage, benefits the course of the illness, whereas other workers

state that there is not sufficient evidence yet available to substantiate this view. The evidence in favour of the use of convalescent serum and "normal" pooled serum in the treatment of the disease is based on the experimental evidence that such sera will neutralize the virus *in vitro*. Further, susceptible monkeys inoculated with the virus can be protected if immune serum is injected intrathecally eighteen to twenty-four hours later. An immunity can also be induced if convalescent serum is injected four days before the introduction of the virus.

Against the view that the serum is of value are the experiments which demonstrated that monkeys infected by the nasopharyngeal route showed lesions involving the brain and spinal cord before any general clinical signs of illness or rise of temperature became manifest. The clinical use of serum in the treatment of the disease must, therefore, be regarded as being in the experimental stage.

Clinical and other Notes.

INDIAN TYPHUS; A PATIENT'S VIEWS.

By Lieutenant-Colonel J. E. M. BOYD, M.C., F.R.E.S.
Royal Army Medical Corps (Retired).

Having been a recent sufferer from the Indian variety of typhus fever, it struck me that a few remarks from the patient's point of view might prove of interest.

At the time of my infection I had been stationed at Ahmednagar, Deccan, for about ten months and had been comparatively fit throughout the period.

The first case of this disease was seen by me just after my arrival in 1932, and was handed over as a case of "tick typhus"; the making out of the case card, A.F. I.1220, fell to my lot, and as the disease was new to me I had taken more than usual interest in the symptoms, progress and treatment.

One point that impressed me was that the case was not a true, textbook, typhus; it and several other cases seen later were not very severe, the face was not congested, the typical stuporose or drunken look was absent, the breath was not more offensive than usual nor was the tongue more coated than one expects to see in febrile cases; not one case suffered from epistaxis, vomiting or delirium.

The louse, *P. humanus,* is not the vector nor could I get the patient to admit having been bitten by a tick. I therefore wrote on A.F. I.1220, to the following effect: "Handed over to me as a case of 'tick typhus,' does not seem to be a case of true typhus and there is no evidence to show that it is due to ticks."

The receipt of the card seemed to have caused some excitement at headquarters as a telegram was received directing that the name "tick typhus" was not to be used, future cases were to be diagnosed as "P.U.O." Later, "typhus" was allowed, but up to the time of my leaving India, in November, 1933, the word "tick" had not reappeared.

During the first season I was at Ahmednagar there were about twenty cases amongst British and Indian troops; the Civil Surgeon told me that he had some similar cases in the jail which he was treating as cases of enteric fever; there were also a few cases in the Families Hospital. The admission of one small child caused some amusement; she was rigidly isolated, a quite unnecessary procedure in my opinion, and on her mother being told that the child had typhus she replied "Is that what it is, doctor? Her little sister had the same complaint about seven months ago and the doctor said that it was chicken-pox."

All the cases show very much the same symptoms. There is an initial attack of fever; this may be diagnosed as P.U.O. or, if there is any previous history of the disease, as clinical malaria; on the third or fourth day a rash appears, which is at first roseolar but later becomes purpuric. The distribution of the rash is general all over the body, including the palms of the hands and the soles of the feet; in some cases however the scalp, axillæ and groins do not show any rash.

Congestion of the throat is common, also congestion of the eyes, with some degree of photophobia. The fever persists for about fourteen days. The staining caused by the rash persists for several months.

During the second season there had been two cases, one a British "other rank" and the other a small child, prior to my becoming infected, my admission being quickly followed by two others to the Families Hospital. We one and all denied having had any knowledge of having been bitten by ticks.

Now to come to my personal experiences. In March, 1926, I was invalided home from India on account of malaria, from which I had suffered for two years previously; my last attack after my return to England was in July, 1926.

The A.D.M.S., Deccan District, Colonel E. C. Hodgson, D.S.O., I.M.S., inspected at Ahmednagar on September 11 and 12, 1933, and as Senior Medical Officer of the station I accompanied him on his inspection.

On September 11, it rained heavily, we were caught in the B.I. Lines and were considerably "damped"; on the 12th it was fine and we had a good morning's work and arranged that in the afternoon, should all be well, my wife and I were to call for the A.D.M.S. and then go on to the Club, but at the last moment our car refused to go, so we walked down to the M.E.S. Rest House; thence we decided to walk to the ruins of an old palace, about a mile away; my wife went back to our bungalow instead of going with us. On our return I walked home feeling very fit and well, had an excellent dinner and went to bed at the usual hour.

On September 13, at about 3 a.m. I awoke feeling very ill, awoke my wife and asked her to get me a dose of quinine and aspirin as I had a bad attack of malaria. My wife got up, gave me the medicine and took my temperature, which was 103° F. I went to sleep again, awoke as usual at 6 a.m. and had my morning tea and bath. About 8.30 a.m. I walked over to the hospital, a distance of about half a mile, dealt with the office work and then went round the wards, but at about 11 a.m. I told my senior assistant surgeon that I was feeling cold and shivery and was going home; I walked home, had lunch, more quinine, and as my temperature was still 101° F., I lay down on the bed most of the afternoon; at 7 p.m. as my temperature was still 101° F., we sent for the staff surgeon. He, having been but a short time in India, was quite willing to agree with our diagnosis of malaria and told me to carry on with the quinine.

When he called next morning my temperature was still 101° F., so it

was decided that I should continue the quinine and aspirin; as I was taking quinine the absence of malaria parasites in my blood was of no diagnostic value. My evening temperature was still 101° F. but on the morning of the 15th it had dropped to 100° F.; examination of my urine showed that I was absorbing the quinine, so as my temperature was still high I suggested that Assistant Surgeon Ray, I.M.D., might come in to see me; he came and, whilst a careful examination was being made, noticed two or three small spots on my abdomen, very suggestive of the enteric group of diseases. That evening my temperature was again 101° F.

Next morning, September 15, my temperature was 100° F., and I was practically covered with a roseolar rash which left no doubt as to the diagnosis. Specimens of my blood, urine and fæces were sent to the District Laboratory and the disease continued to run a normal course.

During the first three nights my wife slept under my net and fanned me most of the time, but after that I made her move away as she could not carry on day and night duty. I also sent for a nursing orderly to help me when washing or using the bed-pan, the latter unpleasant procedure being necessary, as I was ordered to remain lying down and not to exert myself in any way.

My wife and I worked out a diet; it consisted of two-hourly feeds between 6 a.m. and 8 p.m. of milk, soup, barley water and orange juice. For the first two days I wanted nothing, and my wife told me that I did not take half a pint of nourishment on either day.

Regarding my personal feelings; I was, for most of the time, quite indifferent to everything that was going on. If anyone spoke to me I answered, but had no desire to make conversation myself. If food was offered to me I took it, but had it not been offered I would have willingly left it on the plate.

I slept well, usually waking about midnight for a drink, after which I went to sleep again.

On the eighth day of my illness a telegram was received from the office of the A.D.M.S., ordering my admission to hospital at once and stating that two members of Q.A.I.M.N.S. were being sent to look after me. My trip in the ambulance was one of the most unpleasant periods of the illness.

Morning and evening temperatures remained between 100° and 101° F., until the thirteenth day, September 24. On the morning of the fourteenth day the temperature fell to normal, and remained so until my discharge from hospital on the twenty-ninth day of the disease.

My pulse reached 96 on the first day and was as low as 60 on the fifteenth day, usually it was between 80 and 84. Respirations averaged about 20. Bowels were open once daily. There were no serious complications; I developed a slight cough due to chronic bronchitis and an attack of dorsal myalgia in an old football injury which prevented my turning in bed without help, but this soon wore off.

On my admission to hospital I remained on two-hourly feeds until I

was able to take solid food, when I gradually returned to normal meal hours.

When I came back to solid food one or two rather amusing things occurred which seemed to suggest that a course of invalid dieting might be of use if taught at the Royal Army Medical College. The medical officer is responsible for the ordering of the diet, the nurse being only responsible for seeing that it is properly served.

As Ahmednagar is a small station, not blessed with a Government dairy, it is possible to have cows brought to the hospital so that they may be milked before some responsible person; the milk was therefore of very good quality and rich in cream. One evening, at 6 o'clock, I was given half a pint of this milk, and an hour later was offered dinner, consisting of soup, fish, chicken and sweet, which I was unable to face. On another occasion I was ordered a "mixed grill" for my evening meal; such a course may be suitable for lunch, but I found that a mixture of sausage, liver and bacon was rather nauseating when served for dinner. Again the sister suggested giving me two poached eggs at 6 a.m., but after a few remarks from her patient she changed her mind. Generally the food was well served and well cooked.

A typical diet was as follows: 6 a.m. tea. 8 a.m. breakfast, eggs in some form, toast, butter and coffee. 10 a.m. orange juice with glucose. 12 noon, beeftea, fowl, duck or meat, pudding. 2 p.m. orange juice with glucose. 4 p.m. tea with scones or bread and butter or toast. 7 p.m. dinner, soup, fish, chicken or meat, sweet. This diet was ample for anyone lying in bed, and I found on my discharge from hospital that I had lost only one stone in weight.

Generally the diet should be varied, given in small amounts at frequent intervals and well served; a most important point is that the food must be offered to the patient and not simply dumped by his bedside to become covered with flies. It should be realized that he is suffering from an intense toxæmia, is inclined to be lethargic, and unless pressed will not trouble about food or anything else.

Throughout my illness, both out of and in hospital, my wife gave me all my meals, except my chota hazri and orange juice at 2 p.m.; had she not done so it is very doubtful whether my recovery would have been as rapid as it was.

The question of regular dieting is of the greatest importance where "Other Ranks" are concerned; in stations where there are no sisters they should be asked for, so that the patients are not left to the tender mercies of well-meaning but not fully trained regimental nursing orderlies.

Treatment appears to be symptomatic, no general course can be given, but I would strongly recommend a small daily dose of some effervescent saline each morning.

Thanks to the careful attention of my wife I was able to return to duty

on the twenty-ninth day of the disease and so escaped any penalties as regards loss of leave or pay, but was not fit to take any form of exercise for some time after my discharge. I tried to go out shooting, but after a mile or so fell behind and returned to my car. Even when we embarked for England, about the end of November, I was still feeling far from well, but not too ill to embark!

The rash was still visible, or rather the staining of the skin due to the rash was still visible six months after the onset.

The vector is still uncertain; elsewhere ticks have in two cases been proved to be the culprits, but it was not possible in any of the local cases to get anyone to admit any knowledge of having come in contact with ticks. Of course ticks abound, but so do many species of insects. It is not considered that bugs, lice or fleas are responsible for the disease; mosquitoes were under suspicion, as everyone in the station was bitten by these, but there was nothing to prove that they had anything to do with the matter.

I have not gone into the results of blood examinations and laboratory reports, as judging from the voluminous notes on my case and others a full technical report will in due course appear, and it is well to encourage junior officers in the way they should go. One point which I have omitted is that it is quite unnecessary to isolate patients or contacts. The disease is in no way contagious, so that cases can be safely treated in the general wards of the hospital.

Before ending I should like to express my deepest gratitude to Colonel E. C. Hodgson, D.S.O., I.M.S., for the interest he took in my case and for sending the two members of Q.A.I.M.N.S. to look after me in hospital; to Lieutenant, now Captain, B. Blewitt, R.A.M.C., and Assistant Surgeon Ray, I.M.D., for all the trouble they took over my well-being and for procuring the necessary laboratory specimens; to the nursing orderlies of the Royal Fusiliers who were untiring in their endeavours to make me comfortable; members of the I.H.C. also added their quota of assistance. To all I convey my very best thanks.

NOTES ON TWO INTERESTING CASES OF INFECTIOUS DISEASE.

By Major P. J. S. O'GRADY,
Royal Army Medical Corps.

The following notes on two cases of infectious disease which were in Tidworth Isolation Hospital last year may prove of interest:—

Case I.—Cerebrospinal Meningitis.

Recruit J. S., aged 18. Service one month. Previous history: Treated in a reception station for influenza (which was then mildly epidemic), January 24 to 31. Proceeded to his home on sick leave February 1 and returned therefrom on the 7th, on which evening he reported sick and was

detained. Had a "heavy cold" with pyrexia (temperature 101° F.), rapid pulse and somewhat embarrassed breathing. Next day (8th) got out of bed and had a syncopal attack. Pulse almost imperceptible, patient very irritable, struggling, and finally becoming unconscious. Admitted the same day to local cottage hospital. In the afternoon head retraction was noticed, and his temperature rose to 102° F. On February 9 his condition was one of extreme irritability and violence, but he was considered fit for transfer to hospital. He was given ¼ grain of morphia and put in the ambulance with attendants. Admitted to Tidworth Isolation Hospital 3.30 p.m., February 9.

Condition on admission to Isolation Hospital: Still under the influence of morphia; stertorous breathing, contracted pupils; temperature 102·4° F.; pulse 150. Kernig's sign well marked. Head retraction well marked, opisthotonos present; extremely irritable; no rash present.

Immediate lumbar puncture was performed; fluid was under pressure and very turbid; about thirty cubic centimetres were withdrawn. Anti-meningococcic serum, twenty cubic centimetres, was given intrathecally. General condition improved almost immediately, patient became less cyanosed, and much quieter and more conscious. A nasopharyngeal swab was taken.

Patient continued to be violent, morphia ¼ grain was injected. In the evening lumbar puncture was again performed. Fluid was exceedingly turbid and only ten cubic centimetres could be drawn off. Patient very violent; serum was given, ten cubic centimetres intrathecally and twenty cubic centimetres intramuscularly. Morphia ¼ grain repeated.

On February 10 patient was much quieter. Passed urine freely and bladder not distended. Constipated—enema, good result. Fluids taken well. Given potassium bromide thirty grains.

Patient talked quite rationally and did not complain of headache. Asked for a cigarette. A double convergent strabismus developed.

Lumbar puncture was performed in the afternoon—ten cubic centimetres of fluid were withdrawn and ten cubic centimetres of serum given intrathecally. Fluid very turbid and purulent in appearance. An additional twenty cubic centimetres of serum were given intramuscularly. Restless all day. Potassium bromide thirty grains t.d.s. ordered and calomel five grains given.

In the laboratory the cerebrospinal fluid was found to be turbid with purulent deposit. Glucose nil, albumin in excess, globulin present. *Diplococcus intracellularis meningitidis* present on direct examination—and in culture. White cells over 20,000 per cubic millimetre. He slept at intervals during night and was somewhat quieter.

On February 11 lumbar puncture performed. Succeeded in getting needle into canal, but only a few drops of a very inspissated, almost purulent, fluid could be obtained. Serum, twenty cubic centimetres, given intramuscularly. Enema—good result. A rash appeared—a patchy

erythema with some scattered purpuric blotches on the dorsal aspect of the trunk.

Direct examination of cerebrospinal fluid showed *D. intracellularis meningitidis* present—extracellular. Globulin increased; albumin in excess; Fehling's solution not reduced.

On February 12 lumbar puncture again performed under general anæsthetic. Forty-five cubic centimetres fluid drawn off and thirty cubic centimetres serum given intrathecally. Fluid markedly turbid and under pressure.

Cerebrospinal fluid still turbid; 1,655 white cells (polymorphonuclears) per cubic millimetre; Fehling's solution not reduced; globulin present in excess; albumin present in larger quantity; *D. intracellularis meningitidis* present, few in number on direct examination.

Blood examination showed white blood cells 21,250 per cubic millimetre; polymorphonuclears 80 per cent; mononuclears 20 per cent.

He had a restless night—pain and delirium marked—restraint necessary.

On February 13 lumbar puncture performed under general anæsthetic. Sixty cubic centimetres fluid withdrawn, 30 cubic centimetres serum given intrathecally. Fluid still very turbid and under pressure.

He had a better day—more restful—rigidity getting less. Mind more lucid.

Blood examination showed white blood cells 16,625 per cubic millimetre. Polymorphonuclears 65 per cent; mononuclears 35 per cent.

On February 14 lumbar puncture performed under general anæsthetic; sixty cubic centimetres fluid withdrawn; thirty cubic centimetres serum given intrathecally. Had a restless day punctuated with attacks of delirium.

Cerebrospinal fluid much clearer, Fehling's solution not reduced, albumin and globulin not present, 531 cells per cubic millimetre, diplococci still present on direct examination.

On February 15 he had a very restless and delirious night. Almost continuous restraint. Lumbar puncture performed; sixty cubic centimetres fluid withdrawn; thirty cubic centimetres serum given intrathecally. Rigidity very marked—back almost completely arched. Condition critical.

He was exhausted next morning. Had camphor in oil every four hours during the night.

On February 16 a consultation was held with medical specialist (Royal Victoria Hospital, Netley), who agreed with general line of treatment and suggested glucose and egg flips with brandy as there was some difficulty in swallowing.

The cerebrospinal fluid was found to be not markedly turbid; cell content 9,125 cells per cubic millimetre. His general condition decidedly better, but he was still very weak.

On February 17 lumbar puncture performed; forty-five cubic centimetres fluid removed; fluid not so turbid; pressure decreasing rapidly; twenty-five cubic centimetres serum injected.

Cerebrospinal fluid contained 7,000 white cells per cubic millimetre. Urine showed faint trace of albumin. General improvement maintained; squint very prominent; pain less; opisthotonos not so marked.

On February 18 lumbar puncture performed; fifteen cubic centimetres fluid withdrawn. Pressure almost negative and fluid very much clearer. Ten cubic centimetres of serum given intrathecally and ten cubic centimetres intramuscularly.

Blood-count showed white blood cells, 19,375; polymorphonuclears 77 per cent; mononuclears 23 per cent. Patient had a good day—rigidity much less and general condition much better.

On February 19 serum (twenty cubic centimetres) given intramuscularly. Improvement maintained. Desire for food manifested. Oysters and sips of champagne were given. Slept well during the day and night.

On February 20 he was lucid and took an interest in his surroundings. Rigidity much diminished and headache not complained of.

On February 21 temperature rose to 101° F. but dropped again after a few hours. Improvement maintained and patient was now able to lift himself up in bed. Head movements much better. Still had strabismus and diplopia. Serum (forty cubic centimetres) given intramuscularly.

On February 22 serum given (twenty cubic centimetres) intramuscularly.

On February 23 temperature was normal all day.

On February 24 temperature normal at 10 a.m. At 6 p.m. temperature 100·2° F. Lumbar puncture performed, fluid at normal pressure and clear. Twenty cubic centimetres fluid withdrawn and fifteen cubic centimetres serum given intrathecally.

Cerebrospinal fluid clear. Diplococci found on direct examination—very few.

From February 25 until March 6 there was only a slight evening rise of temperature. Serum was given intravenously on February 27 and on March 3, when temperature was normal all day.

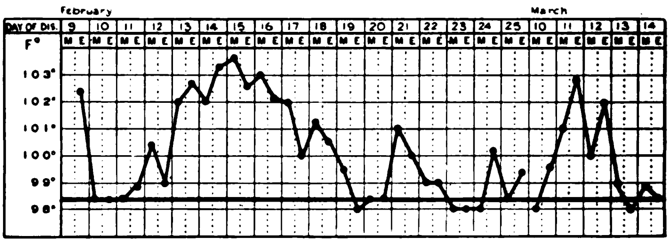
There were evening rises of temperature to 102° F. on March 11 and 12; forty cubic centimetres serum given on the 11th and twenty cubic centimetres on the 12th.

From March 14 to April 20, temperature remained practically normal, dropping to the region of 97° F. nearly every evening. The temperature chart shows the variation in temperature during the case.

The patient was allowed up on April 1. He had had about six weeks' massage and electrical treatment, with general tonics and potassium iodide. His general condition had greatly improved, and although his muscular system had not entirely recovered from its marked wasting, a marked improvement in tone was noticeable. He still had a slight internal strabismus in one eye, but there was no diplopia. He was somewhat apathetic to his surroundings.

He was discharged from hospital on April 20, and sent on six weeks sick leave.

Further history: The patient was admitted to Tidworth Military Hospital July 19, complaining of headache and dizziness, and deafness in one ear. He was treated in hospital until September 8, on which date he was brought before a medical board with a disability of "effects of cerebrospinal meningitis," and was recommended for discharge as physically unfit for military service under existing standards.



On September 16 he was finally discharged under King's Regulations, paragraph 370 (xvi) (a).

Later, in reply to a letter, his mother stated: "The boy is now working on a farm, and is in good health, only he occasionally complains of headache, especially after stooping down for any time."

(To be continued.)

Echoes of the Past.

BURMA 1885-1887. CHITRAL 1895. ASHANTI 1896.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps (R.P.)

(*Continued from p.* 342.)

The Chitral Relief Force, 1895.

The Gilgit Agency in Kashmir territory was established in order to maintain control of the approaches to certain of the Northern passes into India, and especially over the state of Chitral, a mountainous region about the size of Wales, with its capital some 230 miles from Gilgit.

In January, 1895, the Political Agent was Surgeon-Major G. S. Robertson, I.M.S., who, learning that the Mehtar of Chitral had been murdered, proceeded to the capital with his escort, a company of the 14th Sikhs, and 320 Kashmir Infantry. Here he was opposed by a large hostile gathering under a pretender, Sher Azul, which he decided to engage. In the ensuing fight Captain Campbell, who led the troops, was severely, and Captain Baird mortally, wounded, the British retiring into the fort with 55 casualties. Surgeon-Captain H. F. Whitchurch, I.M.S., the medical

officer, came in later in the evening, having, with a handful of Gurkhas, fought his way through the enemy with Baird's dooley. The siege which followed lasted forty-six days. Captain Townshend, in after years the defender of Kut, was in military command. Robertson took an active part in the defence, in the course of which he was wounded. There was sufficient grain in store for the troops, but in the absence of proper instruments, hand-mills of soft stone had to be used for grinding, which rendered the flour gritty. This gave rise to gastro-intestinal troubles. There was no meat for the officers, who had to eat their ponies. The gallant and spirited defence put up has been described by Robertson in "Chitral, the story of a minor siege."

The relief was accomplished on April 20th by Lieutenant-Colonel Kelly with his regiment, the 32nd Sikh Pioneers, who, starting from Gilgit, took his small force through difficult, hostile, and, in parts, nearly trackless country, across the Shander Pass (12,230′), then deep in snow, dragging two mountain guns with him. The 350 miles were covered in thirty-five days. Surgeon-Captain Browning Smith, the medical officer of the force, had to deal with several cases of snow-blindness. A field hospital, under Surgeon-Captain Luard, I.M.S., was brought as far as Mastuj.

The Viceroy expressed his deep sense of the admirable and valuable services of the Gilgit column under circumstances of extraordinary difficulty, and referred to the conduct of the defence as a conspicuous example of heroism and intrepidity. Robertson received the K.C.S.I., Townshend the C.B. and a brevet, Whitchurch the V.C.

Meanwhile three infantry brigades with divisional and L. of C. troops had concentrated under Sir Robert Lowe, at Nowshera. Each brigade, consisting of two British and two Indian battalions, had a British and an Indian Field Hospital. The Divisional troops had two sections of a British, and two Indian Field Hospitals. An Indian Field Hospital and two British sections were allotted to L. of C. At Peshawar was a General Hospital, and at Nowshera, Railway and Rest Camp Hospitals. The first line transport consisted of mules, the 1st Brigade had all mule transport, otherwise the second line was composed of camels and carts. Ambulance transport was provided by dandies and riding ponies. Field Hospitals alone carried tents. The P.M.O. was Surgeon-Colonel T. Maunsell, and Surgeon-Colonel G. Thomson, I.M.S., was P.M.O. L. of C.

A great proportion of the riding ponies proved intractable, and the sick could not be persuaded to mount them; a difficulty in many subsequent campaigns. The Collis dandy, officially sanctioned in 1888 as an improvement on the Lushai type, proved difficult over rough and steep ground; it weighed 71¼ lb. Light medical equipment accompanied bearer parties detailed from the Field Hospitals, but the heavy equipment constantly fell miles behind on the narrow and congested mountain tracks.

On April 3 the Malakand Pass was captured by troops of the 1st and 2nd Brigades, the K.O.S.B. and Gordons assaulting the main position, accom-

panied by Surgeon-Captains Birt and Dowse with pack mules and dandies. After the action, the 2nd Brigade, whose transport had struggled with difficulty to the head of the pass, were ordered back to Dargai, and the wounded accompanied them. The relieving brigade, also with its transport, met them in their descent. "The confusion became so inextricable that the moiety of both brigades spent the night on the cheerless frontage of the cliff. The plight of the wounded was pitiable, as it was impossible to move the stretchers in the dark, and the poor sufferers lay unattended amongst the heels of the jambed transport mules and the cold comfort of the night long chatter of the coolies."[1]

The casualties, 44 wounded, were received into the Field Hospital at Dargai. There were 8 killed.

Some resistance was encountered in crossing the Swat River; Jandol was occupied on the 18th. From here the 3rd Brigade under General Gatacre was pushed on over the Lowari Pass (10,000′) towards Chitral. The advance guard reached the objective to find all resistance collapsed. During May the 1st and 2nd Brigades occupied the Swat and Jandol valleys, the 3rd being spread out between the Baraul valley and Chitral. The road from Jandol to the base was rendered fit for camel transport throughout, and regular staging was established, but the heat in June made any considerable evacuation of sick undesirable, and the Field Hospitals, which with the majority of the troops were sited in hill camps, took on some of the aspects of fixed hospitals. The whole line to Chitral was held till the end of September, 1895.

Both khaki drill and serge were found to be needed in this campaign. The desirability of spine-pads was appreciated, and also the inadequacy of the forage caps affected by the Gurkha regiments. The field ration was reported to be too meagre, being inferior in caloric value to that allowed hard labour convicts at Dartmoor. This was not corrected till after the South African War. Water was ordered to be boiled "wherever possible." The milk purchased by the troops in the villages was almost invariably filthy, and was credited by the P.M.O. with the causation of much intestinal disease. The need for a conservancy establishment to staff the staging camps was soon realized. As in later wars, it was easier to authorize than to obtain. The prevailing sickness was ague, enteric, and dysentery. Relapse of venereal disease contracted in peace stations caused serious wastage in British units.[2] Battle casualties in the whole force numbered 26 killed and 101 wounded. The British, in an average strength of 5,213, had a sick admission rate of 1,530 per 1,000 per annum, and a death rate of 49·6. Enteric accounted for 326 admissions and 94 deaths, dysentery for 565 admissions and 20 deaths, malaria for 1,401 admissions. The Bedfords at Laram Kotal had 128 cases of enteric. The force was in the field for six months.

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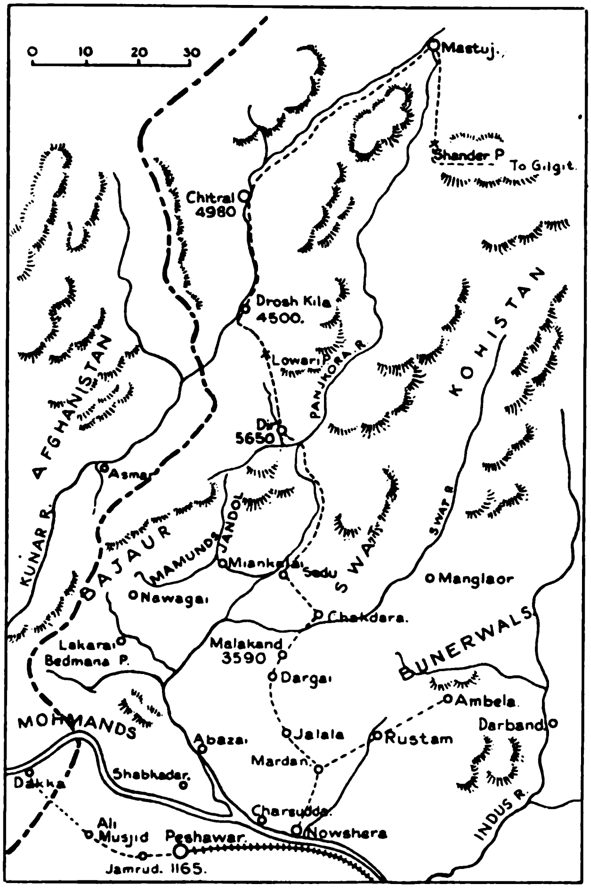
[1] Lionel James, "High Pressure."

[2] The venereal admission rate in Bengal in 1894 was 423 per 1,000.

Surgeon-General Bradshaw and his successor at Simla, Surgeon-General Gore, were congratulated by the Commander-in-Chief on the comparatively good health of the troops. Surgeon-Colonels Maunsell and Thomson each received the C.B.



The March to Kumasi, 1896.

To put an end to the misgovernment and barbarities of King Prempeh of Ashanti, it was decided to despatch an expedition to the Gold Coast in the winter of 1895 under Colonel Sir Francis Scott. The success of the operations, during which there was no fighting, was due to good transport and supply organization. The distance from Cape Coast Castle to Kumasi was 150 miles. The first 70 miles of the road as far as Prahsu were set in order by native troops and camping grounds laid out before the arrival of the force from England. The march, nevertheless, in which an average of twelve miles a day was covered, seems to have proved a considerable strain. The troops engaged were the 2nd West Yorks, a "Special Service Corps"

made up of details from various regiments in the United Kingdom, the 2nd West India Regiment, the Gold Coast and Lagos Hausas, R.E., A.S.C. and 24 medical officers with 85 other ranks of the Medical Staff Corps. The P.M.O. was Surgeon-Colonel W. Taylor (Director General 1901-4).

Lord Wolseley and Sir William Mackinnon, the D.G.A.M.S., both knew from personal experience all there was to be known about Ashanti, and the arrangements made for the interior economy and sanitation of the force were complete and elaborate. Its movements from start to finish were recorded in minute detail in the Daily Press.

No man was embarked who was under 23 years of age or who had less than three years' service. The battalion of the West Yorks, returning from recent service in the Far East, was supposed to be "seasoned." Serge jackets and tropical helmets were worn, and canvas drill gaiters which, it is worthy of record, crumpled up and were extremely uncomfortable. Aluminium tanks were provided for the rest camps and at the base. Water in these camps was boiled under the supervision of a specially detailed officer and filtered through Pasteur-Chamberland filters. The medical units were the Hospital Ship "Coromandel" (110 beds) with Brigade-Surgeon E. Townsend in command and two officers, a base hospital of 75 beds at Cape Coast Castle, and two non-dieted stationary hospitals, each of 50 beds, at Prahsu and Mansu. With the advanced troops was a field hospital, and a bearer company consisting of thirty-three men and five officers. The ambulance transport for this was supplied by 80 cots and hammocks carried by 480 native bearers.

The fallacy that a battalion from Aden would be acclimatized to heat was exposed on the first day's march, when the stragglers from the column strewed the road, and the best part of a company had to be carried into camp. Kumasi was occupied on January 17, and the King deposed.

The official estimate of the sick rate among 884 British other ranks was 356 admissions and five deaths, giving rates of 2,624 and 36·8 per 1,000 per annum. Of the officers 40 per cent. went to hospital, and two, Prince Henry of Battenberg, the Military Secretary, and Major Fergusson, the Royal Horse Guards, died of malaria. The admissions in the West India Regiment were 32 per cent.

Four medical officers including the P.M.O. received special promotion for this campaign, the duration of which was fifty-six days, and two were awarded the C.M.G.

Since that date, locally enlisted troops led by British officers have been employed exclusively on the West Coast, and have more than met all requirements.

Travel.

FROM SINGAPORE TO NORTH CHINA AND JAPAN.

By Major J. R. HAYMAN,
Royal Army Medical Corps.

The following is an account of seven weeks' leave spent on a sea voyage from Singapore to North China and Japan.

Several of the shipping agencies at Singapore offer special tourist rates for this trip. For the proposed journey it was thought that the Blue Funnel Line was likely to be the most attractive. The return fare for seven weeks was $280.00, or £33, and one could live aboard the ship the whole period if one wished to. The "A" boats of 11,000 tons have accommodation for 140 passengers—all one class. The Company employs English stewards on this route. The cabin accommodation, lounges, decks and food arrangements are all that one could reasonably wish for.

I embarked on the S.S. "Patroclus" on April 24, 1933. Our first port of call was Hong Kong which we reached on the morning of the 28th.

During this part of the journey the weather was warm and the sea calm. The boat maintained an average speed of 15 to 16 knots an hour. After leaving Singapore, the passenger list had been reduced to forty, so there was no difficulty in retaining a two-bedded cabin to oneself throughout the trip. We approached Hong Kong through the eastern entrance to the Straits. On either side of the cliffs some very obvious gun emplacements are seen. On the south, or left-hand side, is the island of Hong Kong itself.

The Island was ceded to Great Britain on a perpetual lease in 1842. At that time it was a barren spot, and the haunt of pirates and outlaws. It is said that the Chinese at the time thought that it was a great joke when this hot-bed of piracy was acquired by the "Foreign Devil." Since then, the Forestry Department has been busy, and now the wooded slopes dotted with picturesque bungalows make the island a most attractive-looking place. Beneath the Victoria Peak, the highest point, lies the town of Victoria, the capital of the Colony. This extends for some miles along the north-western fore-shore.

The S.S. "Patroclus" anchored on the opposite side of the Straits at Kowloon. This is a town that has grown tremendously during the last few years. It is also the starting point of the railway to Canton. Adjoining the station is a large luxurious hotel, but apart from this, there are few attractions for tourists in Kowloon. A fast but frequent ferry service enables people to cross from Kowloon to Victoria in ten minutes.

In the afternoon a party of us crossed over to the Hong Kong Hotel at Victoria, and here we hired a car for three hours to take us round the

Island. The driver took us past the lower terminus of the Peak Funicular Railway, and then along the upper western slopes overlooking the town. From here, there is an excellent view of the town itself, the harbour and the mainland in the direction of. Kowloon. The road then winds round the south-western contours of the hills, overlooking the southern portion of the Straits, dotted with small islands. Descending to sea-level again, we passed through several small fishing villages, along the coast road, past the Island golf course, until we reached Repulse Bay. Here there is a very good hotel, so we stopped and had some tea. In the meantime, other tourists arrived and some of them took the opportunity of having a bathe from the sandy beach immediately below the hotel. Leaving the hotel,

FIG. 1.—A view of the main business area of Victoria. The Peak in the distance. Photograph taken from the Kowloon side.

we continued our drive along a winding road through the hills until we reached the north-east portion of the Island. From here we followed the coast road back to the town. This latter part of the journey took us through dock and factory areas, then past the race course, until we reached the somewhat slummy portion of the eastern part of the town. In the immediate vicinity of the Hong Kong Hotel there are the principal commercial agencies and shopping centres. A large variety of silk goods and curios can be obtained at reasonable rates. Camphor-wood boxes, too, seem to be in popular demand by tourists. About seven minutes walk from the hotel is the lower terminus of the Peak Funicular Railway. From here, there is a frequent train service to the upper ridge of the Peak. The gradient is naturally a bit steep in parts, but that rather adds to its attractions. Adjoining the upper terminus is the Peak Hotel.

Unfortunately, a mist usually surrounds the Peak for a considerable portion of the year, but should the tourist arrive there on a clear day he can enjoy very pretty walks and marvellous views from the crest of the hill.

On the following morning we left Hong Kong and continued our journey towards Shanghai. The weather remained warm and fine, but in the evening it became misty. The next day it was cold, wet and very misty. Navigation was evidently difficult owing to the number of islands in this part. The ship was travelling at half speed, punctuated with frequent syren blasts. Later, we heard that a coastal boat had run ashore some fifty miles to the west of us. The local inhabitants had taken the

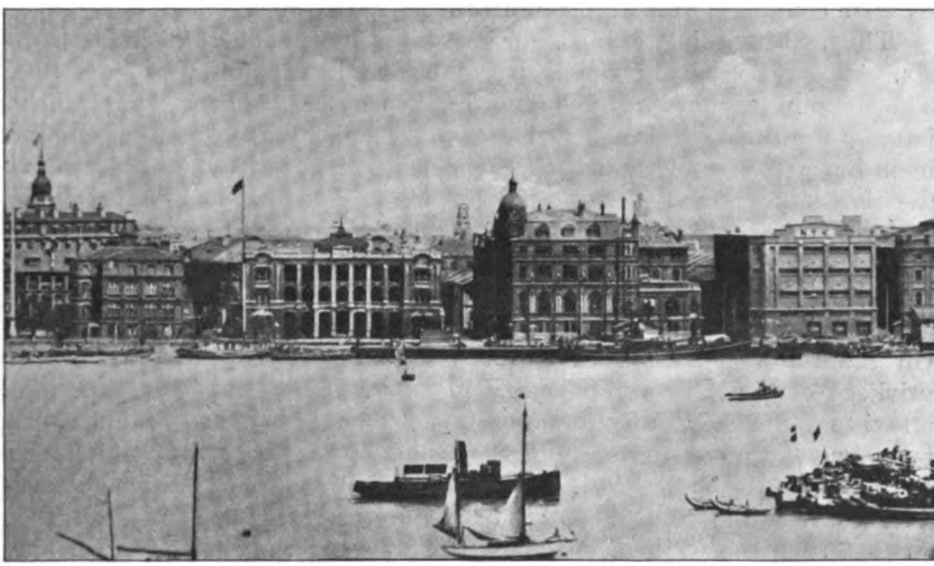


FIG. 2.—The Bund, Shanghai, from the river.

opportunity to become pirates, with the result that the passengers and crew had an anxious and trying time, until the assistance of another boat was secured.

In the evening we passed through the outer fringe of rocks bordering the estuary of the Yangtse River. Here we anchored for the night to take on a pilot and wait for the next tide. The sea was distinctly yellow in spite of the fact that we were still some seventy odd miles from the mouth of the river.

On the following noon, we followed a northerly course until we reached the mouth of the river. At this point the river is so wide that we were unable to see the northern bank. We then turned to the east for a mile and entered a southern tributary, the Yangtse Poo, which leads up to the

town of Shanghai. Guarding the entrance of this river are the famous Woosung (Chinese) fortifications which the Japanese had so much trouble in taking two years ago. The remains of shell-shattered houses gave evidence of the seriousness of the fighting.

The land on either side is flat and extensively cultivated. The width of the Yangtse Poo is much the same as the Thames in its lower reaches and the landscape is also similar. We continued the journey up the river for over an hour until we reached the town of Shanghai, where we turned round and anchored at a wharf three miles below the Bund. In the meantime we had passed a mass of shipping, including cruisers and destroyers of different nationalities, ocean liners and river craft of all descriptions. It was cold and wet when we reached Shanghai, so most of us were content to stay aboard until the following day.

The next morning, May 4, our passenger list had become reduced to six. The weather had changed overnight and it was now warm and fine. The shipping agency provided a good ferry service from the wharf to the jetty on the Bund, three miles upstream. The jetty itself lies opposite the main business area of the International Settlement; two minutes' walk to the right takes one to the entrance of Nanking Street—one of the main thoroughfares leading into the Settlement. On one side of the street is the luxurious Cathay Hotel and on the other side the Palace Hotel. A little further up the street is Cook's Agency. Behind this is a rather obscure alley-way, leading to the hotel which is now used as the military hospital. On the top floor is the R.A.M.C. officers' mess, of which I had the privilege of becoming an honorary member. Leaving the mess I took a taxi to find the Military Headquarters. They are situated in hutments, some two and a half miles from the Bund, and must be somewhere near the border of the Settlement. I wanted to find out whether it was practicable to visit Tientsin and Pekin from our next port of call, Taku Bar. At that time the Chinese and Japanese were fighting in the neighbourhood of Pekin and it was anticipated that the Japanese would take the city. At any rate the information from headquarters was re-assuring, and it was decided that it would be worth while to try and get there. The rest of the day was spent in trying to get some idea of the geography of Shanghai.

The town has a population of over three million inhabitants. The International Settlement has a river frontage of some five miles and extends inland from two to three miles. Adjoining the International Settlement and further up the river is the French Settlement. Near the junction of the two, and facing the Bund, is the well-known Shanghai Club, said to have the longest bar of any club to date. The privilege of a visiting membership is afforded to those who obtain the necessary introduction, and is very much appreciated by those tourists who may be staying at Shanghai for just a few days. Apart from the magnificent buildings facing the Bund, the thing that strikes the traveller is the frightfully congested

state of the narrow streets and alley-ways at the back. Presumably, the Settlement has over-grown its prescribed area, and as it cannot expand side-ways it must extend upwards like New York.

Travellers' tales tell of the night-life of Shanghai, the Russian cabarets, and so forth. In the evening I visited one of them, the Casanova, some two miles from the jetty and adjoining the French Settlement. It was a combined restaurant, cabaret and dance-hall affair. The interior was tastefully decorated, and there was a good ladies' orchestra to provide the music. For the sum of one Shanghai dollar (1s. 3d.), one could get a book of three tickets, and select a partner from the row of professional lady dancers seated opposite. Everything was quiet and orderly, and there seemed to be an

FIG. 3.—A village near the Woosung fortifications. The holes in the protective river wall were made during the bombardment. The village has been re-built since. It was near here that three Japanese sappers tied bombs on themselves, and then rushed on the Chinese defence positions, blowing themselves and the defence position to pieces.

entire absence of any hilarity. May be, these places brighten up a bit in the early hours of the morning.

On the next day, a visit was made to the Chinese city adjoining the French Settlement. It is a maze of small shops, and of narrow congested alley-ways which run in all directions. Among the mass of Chinese humanity was a large sprinkling of deformed, decrepit and importunate beggars. Lying within the area is a miniature "lake" bridged by several archways, and said to have been the inspiration of the "Willow Pattern" design on porcelain. Another place of interest is the Mandarin's Palace with its grotto-like garden. This is a secluded spot, and quite an unexpected retreat to find in such a slummy area. There is also a large Buddhist Temple, or Joss-house. This place contains numerous statuettes of Buddha and his disciples, and in front of them the usual joss-sticks are burning. The combined odours from the joss-sticks and the bazaar were almost overpowering.

We left the Chinese city and motored on to Chapei, which lies on the other side of the International Settlement. This is a part of the Chinese town that was laid waste by the Japanese during the fighting that took place some two years ago. The place is still a mass of ruins, the result of bombardment and fire. Later on, a friend and myself were very fortunate to meet the Dean of the English Cathedral. He was able to give us many interesting details regarding incidents of Shanghai history, and then motored us round some of the suburbs of the town. Shanghai has been described as a very good shopping centre. At any rate, the would-be purchaser has the choice of English, French, Russian, Japanese, and innumerable Chinese stores from which to select his or her requirements.

On May 6 we left Shanghai and continued our journey north towards Taku, the port below Tientsin. The weather continued to be warm and fine, and the sea as calm as the proverbial duckpond. Another passenger and myself decided that we would leave the ship at Taku Bar and proceed to Tientsin and Pekin if we could. The ship was then to continue its voyage to Dairen, and after coaling to return in a week's time. On the afternoon of May 10 we anchored off Taku Bar. There was no sign of land, and except that there were several other ships anchored in the vicinity, we might as well have been in the middle of the ocean. Later on, a tug came alongside the S.S. "Patroclus," and on inquiry, we were told that if we could leave the boat in half an hour we might catch the last train that evening up to Tientsin from Tongka, the railway station at the port.

So my friend and I packed up enough clothing to last us a week, and hoped for the best. It took the tug a good two hours to reach the mainland and then we proceeded up the Pei-ho River for a short distance to stop at the Customs' House. A cursory glance at our kit satisfied the Chinese Customs' official, and we then went a little further up the river and stopped at an improvised jetty opposite the railway station.

Taku is an apology of a port. A mud-hutted Chinese village, a few wharves, one or two European houses, and a railway station. The surrounding country is flat, arid and dusty. Altogether a most uninviting place. The railway office refused to take Shanghai paper money, and we just managed to raise enough silver coins to pay for our tickets. Incidentally, one must expect a certain amount of difficulty in dealing with local Chinese currency, as towns like Hong Kong, Shanghai, Tientsin and Pekin have each their own currency notes and silver. Shanghai is further complicated by having what is known as "large" money and "small" money, the latter consisting of silver coins which have a relatively smaller value than the paper note equivalent. In addition, of course, there is a lot of "dud" money in circulation. The station was picketed by armed Chinese soldiers, who, however, did not afford us much sense of security. The train service was erratic, but on this occasion we were fortunate in that

the train was a little late. The railway coaches were surprisingly good, but the occupants left much to be desired.

We arrived at Tientsin just as it was getting dark. The country we had passed through was sparsely populated and little cultivated. We saw no animals, except a few mules, and scarcely a tree was visible. A hotel porter met us at the Tientsin station and we got into the hotel 'bus. We then motored through the Italian and French Concessions to reach the Astor Hotel in the British Concession. It was a relief to find first-class accommodation and service here. The next morning I called at Military Headquarters which lies within seven minutes' walk of the hotel.

From the information available, it seemed that there was little risk in continuing the railway journey up to Pekin, though the local war situation was critical, and the train service erratic. Apart from that, it came as a pleasant surprise to learn that one could obtain military concession rates for certain hotels, and railway travelling. For the rest of the day we explored some of the neighbouring parts of the town. We had expected the weather to be cold but found the thermometer rising above 80° F. at midday. Tientsin has a population of approximately a million inhabitants. The town is divided into the Chinese city and the Settlement areas. The Settlement area is again subdivided into different concessions, for the British, French, German, Austrian, Russian, Japanese, Italian, and possibly other nationalities. The German, Austrian and Russian Concessions appear to have reverted to Chinese control. The British and French concessions are very attractively laid out, and remind one rather of a modern provincial town, with good roads and fine buildings.

The Chinese city was at one time surrounded by the usual high protective wall, but this for the most part has now been pulled down. The town is connected with the coast by the Pei-ho River which is navigable to coastal boats and ships up to twelve to fifteen feet draught. At one time a considerable volume of trade was carried on at Tientsin, but owing to the constantly recurring civil wars, business at the present time is at a low ebb. A local industry that still thrives is the manufacture of carpets. These are either hand-woven or machine made. In appearance and texture they resemble the Persian type, with soft thick pile. A good ready-made carpet measuring twelve feet by ten feet can be bought for £12 to £18. Or, if the purchaser prefers it, a carpet of his own design, pattern and measurements can be obtained at so much per foot. In the afternoon we visited a collection of Chinese curio shops in the Japanese Concession area. The cross-roads, here, were barricaded with sand-bag emplacements and guarded by Japanese.

(*To be continued.*)

Current Literature.

GILBERT, Ruth, and COLEMAN, Marion B. **Undulant Fever in New York State.** *J. Infect. Dis.* 1934, v. 54, 305-12. [10 refs.]

Data were collected of over 400 cases of undulant fever occurring in New York State. Six of these proved fatal. *Br. abortus* was isolated from the bile of two patients operated on for cholecystitis, and from the pustular rash on the arm of a man who had assisted in the manual delivery of a calf. The authors doubt whether a tenth of the cases of undulant fever are recognized. Undiagnosed cases are frequently found by examination of sera sent into the laboratory. Moreover, of approximately 200,000 Wassermann sera examined in the last three and a half years 0·3 to 0·4 per cent have agglutinated *Br. abortus* at 1/80 or over. Over 30 per cent of these reacting sera agglutinated at 1/320 or higher. Examination of 88 Brucella strains from patients' blood and cows' milk collected in various parts of New York State showed that, with the exception of three from laboratory workers, all but one were of the bovine type. Thirty-one strains from human patients and 42 from cows' milk were incubated in duplicate under aerobic conditions and in an atmosphere of 10 per cent CO_2. All strains developed well in 10 per cent CO_2, while only 5 human (2 from laboratory workers) and 4 milk strains grew in primary aerobic cultures. It is concluded that undulant fever in New York State is mainly due to the bovine type of *abortus*. Since a large proportion of the patients had no contact with cattle, but had used raw milk or cream, it would appear that efficient general pasteurization would bring about a marked diminution in the incidence of this disease. G. S. WILSON.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 9.

ARBATSKAIA, E. and MOROSKIN, H. La reazione intradermica (I.D.R.) quale metodo diagnostico nella brucellosi. **[The Intradermal Reaction in the Diagnosis of Brucella Infections.]** *Giorn. d. Batter. e. Immunol.* 1934, v. 12, 979-89. [12 refs.] English summary (10 lines).

Two antigenic reagents were prepared. The first was a saline suspension of four-day agar cultures of four different strains of Brucella, heated to 70° C. and standardized to a final opacity of 2,000 million *coli* per cubic centimetre. The second consisted of a mixture of L2 filtrates of four-week old glucose broth cultures of fifteen strains of Brucella, and was preserved with 0·5 per cent phenol. The broth was made with human placenta so as to avoid non-specific protein reactions. The intradermal test was carried out by inoculating 0·1 cubic centimetre of either reagent into the arm. A positive reaction became noticeable in six to eight hours and reached its maximum in twenty-four to forty-eight hours. It consisted of a red, painful, indurated local swelling, sometimes accompanied by enlargement

of the axillary glands and by a slight rise in temperature. Pseudo-reactions were apparent within a few minutes. A number of undulant fever and other patients were tested, though not always with both reagents. Of 35 definite undulant fever patients, 34 gave a positive intradermal reaction, 30 a positive agglutination reaction, and 21 a positive blood culture. Five of the patients gave a positive intradermal reaction in the absence of agglutinins. In four of these a positive blood culture was obtained, thus proving the correctness of the diagnosis. In only one patient were agglutinins present when the intradermal reaction was negative, and in this patient the skin test became positive as the general condition improved. In cases of suspected Brucella infection the intradermal and agglutination tests agreed. In 139 control patients there was again agreement between the two tests, except that the agglutination test was weakly positive in two cases of typhoid fever, while the intradermal test was positive in 11 out of 36 cases of tuberculosis. In this last group a positive reaction was obtained with the bacillary suspension but not with the broth filtrate. Moreover, when the strength of the bacillary suspension was reduced to 500 million per cubic centimetre, the reaction no longer occurred. The authors consider the intradermal test to be most valuable, and to be more delicate than the agglutination test. They recommend that it should be performed with a bacillary suspension standardized to 500 million *coli* per cubic centimetre. The use of this strength avoids the occurrence of skin necrosis, and of non-specific reactions in patients with a high level of skin sensitivity.

G. S. WILSON.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 9.

THOMPSON, R. **The Distribution of *Brucella abortus* in the Infected Udder.** *Canadian Pub. Health J.* 1934, v. 25, 229-33. [12 refs.]

The gravity cream of separate quarter samples taken from cows infected with *Br. abortus* was cultured on gentian violet liver agar. It was found that the organism was excreted persistently throughout the entire lactation period by certain quarters, except when mastitis intervened. After the mastitis died down it was sometimes, but not always, possible to demonstrate *Br. abortus* again. The author draws attention to the fact that in twelve out of thirteen cows examined *Br. abortus* was located in the right hind quarter of the udder. He points out the desirability of examining the milk from each quarter separately.

G. S. WILSON.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 9.

GORDON, J. E. & BADGER, G. F. **The Isolation Time of Scarlet Fever.** *Amer. J. Pub. Health.* 1934, v. 24, 438-48.

The detention period for scarlet fever in the United States is usually four weeks. To be successful isolation must result in protection for

immediate and remote contacts and impose minimal restrictions on the patient. Since isolation regulations were formulated scarlet fever has become a less formidable disease and the time has come when the isolation period may be decreased. Moreover present day practice is empirical and imposes general rules for all patients, whereas in diphtheria and typhoid rules applicable to individuals are imposed. In scarlet fever, however, bacteriological standards of freedom from infectivity have been found unsatisfactory and the authors have attempted to define differences in the clinical and epidemiological nature of the disease which could be applied practically to the individual. The incidence of secondary cases was found to vary with age, the presence or absence of complications, and the season of the year. Since 1929 the period of isolation for clean cases has been varied to admit of a consideration of these factors so that during the first six months of 1933 patients under 15 years were detained for four weeks, whilst for those over, the period was three weeks. In the second half of the year the periods were three weeks and two weeks respectively. By this method the time of isolation of all cases was reduced by 9,000 days and by 30 per cent in the case of adults. The infecting case rate has not increased and the relative frequency as between adults and children has not been disturbed. The relatively greater infecting case rates during winter as compared with summer have remained unaltered also. The decrease in the isolation period had no deleterious effect on the patient's well-being.

Other factors having a bearing on the present methods of administrative control in scarlet fever have been investigated, including the subject of the actual value of isolation itself. For example, a study has been made of 1,065 persons with reported and verified scarlet fever, together with their familial, school and neighbouring contacts and according to available information there was found at least 253 definite and 338 other possible sources of infection who showed sore throats and various other naso-pharyngeal and allied infections. The extent of these equally important and at present uncontrolled sources of infection justifies minimal restrictions of reported cases and the authors doubt the possibility of controlling scarlet fever by rigorous isolation measures limited to reported cases. The time relationship between primary and secondary cases has been worked out and it was found that three-fifths of all secondary cases were probably infected before isolation was established. Secondary cases during the course of home isolation were more common than when hospital isolation was carried out, but this was offset by the number of secondary cases which appeared after discharge of the hospital patients. Early reporting is therefore required to reinforce the effect of isolation. There was little to choose between home and hospital isolation when considered from the standpoint of secondary infections, and home isolation had the advantage that a high percentage of cases were released from isolation at the expiry of the minimal period. Home isolation should therefore be given greater emphasis. A certain number, however, will always require hospital

isolation, but these in America will seldom exceed a quarter of the total. When carried out it should be as brief as possible consistent with the safety of the patient and the contacts.

A. JOE.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 10.

LEAGUE OF NATIONS, HEALTH ORGANISATION, EASTERN BUREAU, ANNUAL REPORT FOR 1933 [PARK, C. L., Director]. Pp. 33-42; 43-9. **Annex. I. Spread of Plague by Maritime Traffic. Annex. II. Spread of Cholera by Maritime Traffic.**

(i) The present pandemic of plague began in Canton early in 1894 and spread to Hong Kong and Bombay and thence by ships to Egypt, Madagascar, Japan, Malaya, Cochin China, Siam, Burma, Java and Ceylon. Australia appears to have been infected from Noumea and South Africa from Madagascar and South America. It is clear that the most dangerous types of cargo are rice, cotton, other grains and foodstuffs, and the most dangerous ports are Bombay, Rangoon and the grain-exporting ports of South America. Raw cotton is a particularly important medium in the conveyance of infected fleas.

The time of the year at which rat-attractive cargo is imported or exported may be a deciding factor in the development of an epidemic of plague. High temperature and low humidity affect the flea vectors of plague unfavourably; thus the long off-season for plague in South-Eastern Madras is associated with a mean monthly temperature of 81° F. and relative humidity below 76 per cent. The plague season is not only more favourable for fleas, but also for the transmission of *B. pestis*. Conditions in ports of arrival as regards rats and flea prevalence are important. Without proper harbourage rats have a Cheopis index too low for the continued transmission of plague. *X. cheopis* is undoubtedly the chief vector. Places where only *X. astia* exists are not likely to get severe and recurring epidemics. It has been suggested that the opening of the Suez Canal in 1869 led to increased trade with Egypt, particularly in cotton, that *X. cheopis* was thus introduced into India and spread throughout the country, thus providing the necessary factor for the development of epidemic conditions when plague was introduced in 1896.

In ships the existence of rat-harbourage, an available supply of food and water and a rat colony favour the spread of plague.

The rats on board may be infected by other rats or by infected fleas. It is generally stated that adult fleas will die in five days in the absence of any host. Larvæ or pupæ may survive one or two months but do not carry plague. It appears, however, that the longevity of infected fleas varies with the temperature, being much greater at low temperatures. Conditions on shipboard along tropical and sub-tropical routes are specially favourable to the preponderance of *X. cheopis*, but over what distance

transfer of infection by fleas can take place without the intermediary of a rat epizootic is uncertain.

Disinfestation of bags of grain by exposure to the heat of the sun has proved unsuccessful in South India.

Man himself can hardly play an important rôle in conveying plague from one country to another. The requirement of the International Sanitary Convention that all ships must be periodically deratized or be permanently kept in such condition that the rat population is reduced to a minimum and the rat-proofing of ships will greatly reduce the danger of the propagation and spread of plague.

(ii) Since cholera is spread by man himself the degree to which an infected port is a danger depends very largely on the extent of the passenger traffic, particularly in the emigrant and pilgrim classes. The main endemic centres are British India and China, both of which have an extensive emigrant traffic. The incubation period being short an epidemic may develop even during a comparatively short voyage.

D'Herelle considers that patients who recover are only infective up to the time when symptoms definitely abate, and there is general agreement that cholera cases are free from vibrios in seven to fourteen days after convalescence.

Couvy, after exhaustive inquiry, concludes that it has never been possible to attribute with certainty to "healthy carriers" the responsibility for a single case of infection. Thus a "healthy ship" arriving from a cholera-infected port after a voyage of more than five days is unlikely to be any real danger.

In endemic areas certain strains of non-agglutinating vibrios can be regenerated and become agglutinable. It is not known whether these regenerated vibrios can produce the disease.

The seasonal incidence of cholera is well recognized. This affects the spread of the disease overseas because the existing foci of endemic cholera are in the Northern Hemisphere, and the most favourable season there corresponds with the most unfavourable in the Southern Hemisphere.

The risk of transporting the disease in ships has been greatly diminished by the general application of inoculation to passengers leaving infected ports in the East.

It has been suggested that treatment by mixed antidysenteric and anticholera-phage should be carried out on all pilgrim ships leaving cholera-infected ports and this might well be of great value.

Countries of arrival may require deck passengers from infected ports to be kept under observation until the quarantine period has expired or may conduct examination of stools for vibrios.

Finally the sanitary condition of the ports of arrival is of the greatest importance.

CHAS. F. WHITE.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 10.

Reviews.

ANNALS OF THE PICKETT-THOMSON RESEARCH LABORATORY. MONOGRAPH XVI, PARTS I AND II, INFLUENZA. By David Thomson and Robert Thomson. London: Baillière, Tindall and Cox. Pp. 1557 and 28 Plates. Price 63s. per volume.

These two large volumes represent for the most part abstracts of over 4,000 communications that have been published in relation to influenza. An enormous amount of industry must have been expended by the authors in collecting the information and they are to be congratulated on the general arrangement of the work.

The greater part of this treatise is concerned with the relationship of *H. influenzæ* and the associated organisms to influenza and its complications and only a fraction of the letterpress is devoted to the consideration of what is regarded by the majority of scientists as the cause of the disease—the virus. This is to be expected in a publication of this nature, although the editors pay full tribute to the recent work carried out in England and America on both the human and porcine virus.

A full bibliography and a reliable index are included in the second volume.

POCKET MEDICAL DICTIONARY. George M. Gould, A.M., M.D. Tenth Edition. Revised by C. V. Brownlow. London: H. K. Lewis and Co., Ltd. Price 10s. 6d. net.

The tenth edition of this handy dictionary has been compiled to meet the changes in medical science and the consequent enlargement of the medical vocabulary.

While attempts have been made in this, as in previous editions, to exclude words which are not of sound or permanent value, a total of 40,000 terms still remains for definition. The definitions are concise and accurate and the pronunciation of each word is clearly indicated.

The book also contains dose tables, anatomical tables and a useful summary of signs, symbols and abbreviations, the whole forming a compact book of reference.

MASSAGE AND REMEDIAL EXERCISES. By Nöel M. Tidy. Second Edition. Bristol: John Wright and Sons, Ltd. 1934. Pp. xii + 414. Price 15s. net in British Isles.

The cover title of this well-illustrated and compact book scarcely describes adequately its purpose as it contains much information of an anatomical and physiological nature so necessary to students and practitioners who have not always time or easy access to the larger textbooks.

The chapters and sequence are well arranged and there is a very complete index.

Fractures, dislocations, sprains, muscle injuries, wounds, scars and stiff joints and their diseases are all dealt with.

Diseases of the nervous system, motor and sensory neurons, brain and spinal cord, peripheral nerve lesions, functional nervous diseases, diseases of muscle, deformities of the extremities and spine all find a place, as well as constitutional diseases, diseases of the heart, blood, lymph vessels and respiratory organs.

The last chapter on abdominal and pelvic conditions is of special interest to the gynæcologist.

The book should find a place in the library of every qualified masseur and specialist who has to serve abroad where at times the latest textbooks on massage and remedial exercises are not readily available.

K. P. McK.

A Synopsis of Medicine. By H. Letheby Tidy, M.A., M.D., F.R.C.P. Sixth Edition. Bristol: John Wright and Sons, Ltd. 1934. Pp. xvi + 1112. Price 21s. net.

Classics need no review.

This pivot of medical education appears in its sixth edition and it is with a sigh of relief that we see it at last reposing on the bookshelf ready in a moment to solve the difficulty of the student, the temporary embarrassment of the "Member"—perhaps even to sway the august opinion of the "Fellow," if such heresy may be hinted at. As we are not reviewing this book we may indulge in the harmless speculation as to how many former medical students "walk Piccadilly" owing to "not reading Tidy."

J. H.-S.

What to do in Cases of Poisoning (Murrell). By Philip Hamil, M.D., D.Sc., F.R.C.P. London: H. K. Lewis and Co., Ltd. 1934. Pp. viii + 204. Price 5s. net.

Since it first appeared in 1881 this useful book has been very popular, and now reaches its fourteenth edition.

In it will be found in accessible form the symptoms of nearly every known poison with their appropriate treatment, immediate and remote. The book is sufficiently small to be carried in the the practitioner's bag for instant reference when required. Of its great value there can be no two opinions.

J. H.-S.

Aids to Public Health. By W. J. Aitchison Robertson, M.D. London: Baillière, Tindall and Cox. Pp. viii + 208. Price 3s. 6d.

The attempt on the part of the author to provide a small book which will recall to the mind of an examinee much that his examiner desires to elicit has, on the whole, been successful.

As it condenses the science of Public Health into 200 small pages, the book will provide somewhat indigestible mental fare for the average medical student, but at the same time should prove of value to him when revising the subject before an examination.

Certain inaccuracies are apparent, notably in the sections on malaria and vitamins, and the book would be considerably improved were these sections brought abreast of present-day knowledge. F. H.

Correspondence.

THE CLINICAL IMPORTANCE OF ACHLORHYDRIA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—Officers of the Corps who had not the privilege of listening to Dr. Arthur F. Hurst's most interesting address on "The Clinical Importance of Achlorhydria" at the Annual Meeting of the British Medical Association at Bournemouth have now the opportunity of reading it in the *British Medical Journal* of October 13.

As Director of Hygiene I am particularly interested in his statement in regard to the antiseptic action of the hydrochloric acid in the gastric juice and the uses it is possible to make of this knowledge in the prevention of such diseases as the dysenteries, enteric and paratyphoid fevers, etc.

We have, of course, for many years used dilute acid as a prophylactic against cholera, but so far as I am aware no attempt has ever been made to limit its administration to those men who were suffering from hypochlorhydria or achlorhydria or to use it as a prophylactic in other intestinal diseases.

In July, 1932, Dr. Hurst very kindly wrote to me on this subject, and gave me much of the valuable information which is now contained in his present paper.

I discussed the matter with the Director-General and also with the Medical Specialist at Millbank, who was shortly due for a foreign tour, in the hope that Dr. Hurst's suggestions might be given a practical trial in some foreign station.

I do not think it would be a practical proposition to give test meals to all troops before proceeding abroad, but it might be worth while to apply the test to troops in a station where an outbreak of any of these intestina diseases is threatened.

In face of an outbreak of cholera dilute acid has been given in the past to all men without any test. This procedure may endanger those who are victims of hyperchlorhydria, and in this connection the following table is of interest :—

BRITISH ARMY IN INDIA—OTHER RANKS.

Year	Duodenal Ulcer				Gastric Ulcer			
	Admissions		Deaths		Admissions		Deaths	
	Number	Ratio per 1,000	Number	Ratio per 1,000	Number	Ratio per 1,000	Number	Ratio per 1,000
1933 ..	27	0·5	1	0·01	18	0·3	1	0·01
1932 ..	10	0·2	—	—	11	0·2	—	—
1931 ..	18	0·3	1	0·02	18	0·3	3	0·05
1930 ..	13	0·2	1	0·02	6	0·1	—	—
1929 ..	5	0·1	2	0·04	6	0·1	—	—

On the other hand, the application of a test meal would only disclose those suffering from achlorhydria or hypochlorhydria on the day of the test, but any man subsequently developing gastritis, which is apparently the commonest cause of achlorhydria, might escape the necessary prophylactic treatment.

I am sending this letter to you in the hope that Dr. Hurst's suggestions may receive consideration by officers serving overseas.

I am, etc.,

*War Office, S.W.*1.
October 18, 1934.

P. H. HENDERSON, *Major-General,*
Director of Hygiene.

Notice.

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE (UNIVERSITY OF LONDON) INCORPORATING THE ROSS INSTITUTE.

THE next series of lectures and demonstrations on tropical hygiene, which are intended for men and women outside the medical profession proceeding to the tropics, will be given by Lieutenant-Colonel G. E. F. Stammers, O.B.E., M.R.C.S., L.R.C.P., D.P.H., and Sir Malcolm Watson, LL.D., M.D., D.P.H., from December 10 to 14, 1934, inclusive.

The course comprises five lectures which will be held from 3.30 to 5 p.m. each day.

In addition to providing simple rules for guidance in regard to personal hygiene and preparation for life in the tropics, these courses of instruction also include information on some of the more common diseases and their prevention.

The synopsis and other particulars can be obtained from the Organizing Secretary, Ross Institute of Tropical Hygiene, Keppel Street, Gower Street, W.C.1.

ERRATUM.

"Review of Fevers of the Typhus Group (Vector unknown), &c." JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, No. 5, vol. lxiii, page 313, *delete* "again" in the last line.

INDEX TO VOLUME LXIII.

C.N. = Clinical and other Notes.
C.L. = Current Literature.

Index to Volume LXIII.

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Original Communications.

SOME MILESTONES OF ACHIEVEMENT IN ARMY HYGIENE AND A FEW SUGGESTIONS FOR FURTHER PROGRESS.[1]

BY MAJOR-GENERAL P. H. HENDERSON, C.B., D.S.O., K.H.P.

I REGARD the charter of the Army Hygiene specialist to be the conservation of the man-power of the Army through the maintenance and promotion of health and the prevention of disease. The charter, therefore, embraces everything which affects the health and well-being of the soldier and also of his family, for, if the married soldier has not got a well-housed, well-fed, happy and healthy family, his morale and health, and with them his work, will suffer. I propose to confine myself chiefly to those milestones in hygiene which affect the soldier's environment and life in barracks and, to a less extent, in the field. The marked success of certain other measures in preventive medicine, such as inoculation, have received more public notice in the past, although the subjects with which I will deal are of equal importance, but, because they are constantly before us, any progress in regard to them is apt to be taken for granted.

I should like to say that such progress as has been made in regard to Army Hygiene is very largely due to the initiative of hygiene officers and to the close co-operation maintained between the Hygiene Directorate (which embraces the hygiene specialists in Commands, Districts and Educational establishments) and other branches of the Army, and more particularly with those branches concerned with Engineer Services, and the feeding and housing of the troops.

[1] Reprinted from the *Proceedings of the Royal Society of Medicine*, vol. xxviii, p. 1 (United Services Section, p. 1), by permission of the Honorary Editors.

MILESTONES

(1) *Education.*—Since I joined the Army some thirty-five years ago, education in regard to matters of hygiene and sanitation has improved in a very marked degree. Most of this improvement has taken place since the World War, largely as the result of the formation of the Hygiene Directorate which was created under Army Council Instruction No. 545 of September 16, 1919, and the valuable support this Directorate receives from the Army Hygiene Advisory Committee. Since the formation of this Directorate, not only has the teaching of hygiene and sanitation at the R.A.M. College and Army School of Hygiene been re-organized on up-to-date and thoroughly practical lines, but Commands and Districts are now supervised by fully qualified specialist officers, and £200 is at the disposal of the Director of Hygiene annually for purposes of research—some of the valuable fruits of this research will be referred to later.

Under the duties for which the R.A.M.C. is maintained, first place is given in the R.A.M.C. "Training Manual" to "maintenance of health and prevention of disease," and prevention of disease is also given priority in the general duties of the Medical Services in the Army Regulations. That is as it ought to be, and it is pleasing to note that in civilian life there is a strong movement afoot to follow our good example in this direction, and thus bring the practice of medicine throughout the country into its true perspective.

The education of officers and other ranks of the Medical Services of the Army in hygiene and sanitation is carried out at the R.A.M. College and Army School of Hygiene, and that of officers and other ranks of other arms at the Army School of Hygiene. The education of the combatant branches is also carried out in all stations by means of lectures delivered during the individual training season, and—perhaps most important of all—by practical demonstrations during inspections of barracks and camps by properly trained hygiene specialists. What is the result of all this? It is that the majority of combatant officers, who, when I first joined the Service, took little interest in matters affecting the health and well-being of their men, now take a genuine and live interest in all these problems with gratifying results.

In testimony of this it was claimed a short time ago by that eminent biographer, Sir George Arthur, that the recent improvements in the soldier's environment, particularly in regard to messing and accommodation, were due solely to the personal efforts and initiative of the present-day commanding officers of units. Now, while a scrutiny of the official files would probably reveal the fact that these improvements originated in recommendations made by hygiene officers, it is a great satisfaction to know that the new interest taken in such important matters by combatant officers should induce this well-known writer to make such a claim, and it is certain that, because of the greatly increased knowledge of hygiene possessed by staff and other officers, it is essential, if medical officers are to continue to be in a position to give advice on this subject to these officers, that they should keep themselves thoroughly up to date.

(2) *The housing of the troops.*—Up to the middle of the nineteenth century the housing of the soldier was deplorably neglected, and inquiries instituted just before and after the Crimean War showed that the high mortality from pulmonary diseases

prevailing at that time was due to the overcrowding of men in insanitary barrack-rooms. To give but two examples: in England in 1820 the beds were arranged in double tiers, and in Jamaica the men slept in hammocks touching each other.

It was not until 1851 that a definite cubic space of 450 cubic feet per man in barrack rooms at home was fixed. In 1855 Lord Monck's committee investigated the conditions then prevailing, and it is interesting to note that the motive of that committee was identical with ours to-day, namely, a desire not only to raise the standard of health and well-being of the soldier, but also to improve the tone in the barrack room, and thus produce better fighting material.

The chief recommendations of that and later committees were to increase the cubic and superficial areas allotted to each soldier, and the construction of separate married quarters, although they also made other suggestions for improving the environment of the soldier which were not acted upon until much later.

In 1857 a Royal Commission was assembled under Sidney Herbert, and this Commission found that the death-rate among soldiers in peace time was twice as high as among the civilian populations of the same ages, the Army death-rate being then recorded as 17·5 per 1,000. In 1933 the death-rate for the Home Army was 1·87 per 1,000 and that for the whole Army at home and abroad 2·15 per 1,000, while the civil death-rate for England and Wales during the same year was 12·3 per 1,000. As the result of the Royal Commission's recommendations in 1857, the space per man was raised to 600 cubic feet at home and 800 cubic feet abroad. A survey of the barracks in the United Kingdom at the time showed that, based on this allowance, they fell short of the necessary accommodation by about one-third. The important factors of floor space and the space between beds were not definitely laid down until a much later date. Although not regarded so at the time, a most important recommendation of the Royal Commission was the utilization of medical assistance in the selection of sites for barracks and in other matters affecting the soldier's environment.

The Barrack and Hospital Improvement Commission was next formed to consider in detail the recommendations of the Royal Commission and in 1862 was constituted a Standing Committee. In 1865 their title was changed to that of "The Army Sanitary Committee," which remains a very active body to-day under the title of "The Army Hygiene Advisory Committee," presided over by the Director of Hygiene. The duties of this Committee in regard to barracks are as originally laid down: viz. (1) To report on new sites and on block plans of new barracks—making whatever inspections may be necessary; (2) to report on all type plans, especially with reference to sanitary details; (3) to report on all new principles of construction or fitments from the hygienic aspect. The recommendations of this Committee in regard to housing are later dealt with by the Barrack Synopsis Committee on which the Directorate of Hygiene has a representative.

When we reflect on the conditions under which the soldier was housed in the past, of which I have given you but a brief summary, and when we inspect some of the barracks and huts still in existence which were erected at the time of the Crimean War or a little later, we can congratulate ourselves that, as a result of close coöperation between the Hygiene Directorate and the Engineer Services, we have definitely reached a milestone of achievement in the latest barrack design.

In contrast to many of the older barracks—too many of which are still in

existence—in which the rooms, each accommodating from twenty-four to thirty men, are square-shaped, the windows, equipment shelves, fireplaces and beds are badly placed, and the floors made of soft wood, the latest design of barracks in the United Kingdom shows the following important improvements. It consists of two-story blocks containing four barrack rooms (two on each floor). On each floor one of the rooms holds 13 men and the other 17 men. There is also a N.C.O.'s room and, leading off from between the two barrack rooms, a sanitary annexe containing ablution basins, W.C.s and urinals, all under cover.

The rooms are oblong in shape, and the beds and windows are arranged in sequence as follows: A bed next the end walls, then a window alternating with two beds throughout the length of the room. This ensures each bed having a window at one side of it. Windows on either wall reach to near the ceiling and face each other, and are of adequate dimensions to permit of good cross ventilation. Each bed has 60 sq. ft. floor space and 600 cubic feet air space, and there is 6 ft. linear wall space between the centres of beds. Metal equipment boxes are placed over the correct position of each bed. Floors of hard wood suitable for polishing are provided. Heating is still by coal fires placed back to back in the centres of the rooms, but though this method of heating is cheerful and the men like it, it has the grave hygienic objection that in cold damp weather men tend to congregate round the fires, and so disseminate such dangerous infections as cerebro-spinal meningitis and influenza.

The ideal method of heating, in my opinion, is properly distributed panel heating, as this obviates the risk involved by men congregating as they do around fires, and also their tendency where central heating is provided to dry dirty wet clothes on the hot pipes or radiators and thus create a very unpleasant hot, humid atmosphere.

The reduction in the numbers of occupants from 24 or more to 17 and 13 greatly facilitates segregation in the presence of epidemic disease, thus limiting its extent.

(3) *Married Quarters.*—In 1855, when Monck's committee were investigating the condition of barracks, married soldiers, up to 6 per cent of the strength of the unit, lived in the barrack rooms with the single men, and were separated from them only by blankets hung across the room or by curtains round the beds. In some cases even this apology for decency did not exist.

The first improvement of these conditions was the allotment to married soldiers of barrack rooms apart from the single men, but with several families in the same room. Such conditions continued up to the 'seventies, when separate quarters were built in the form of single rooms, arranged four on a floor, in a building of two or three stories in height. Some of these single "Y" quarters, as they were later called, were in existence up to a few years ago. Then followed the three-roomed type, consisting of a living room, bedroom, and scullery, to be superseded later by the barrack attic type and the depot type with more rooms and in which the larger quarters were allotted according to *rank*.

Up to now, W.C.s were detached from the quarters. Then came the verandah type in which the W.C.s were provided at the ends of the blocks, and about this time also quarters were allotted according to the size of the soldier's family and not by rank.

About thirty years ago statistics were taken, and as a result married soldiers'

quarters were reduced to three types without distinction as to finish or as to the rank of the occupant. These were designated "A," "B" and "C" type quarters and had one, two, and three bedrooms respectively and each had a living room and scullery.

The next improvement was the addition of a W.C. to each quarter and the provision of a Sitz bath, and since the World War and as the result of recommendations made by the Hygiene Directorate in coöperation with the Royal Engineers, each new quarter is now provided with (in addition to the living room and bedrooms) a W.C., scullery with hot water laid on to the sink, a larder, bath with hot and cold water, a coal store, a wardrobe fixture with extending hanger for clothes in each bedroom, and in the best bedroom a cupboard for rifle and accoutrements. Drying posts may be provided on the scale of two per quarter, and where suitable arrangements can be made with a gas company, permission is given for the installation by the company of a cooker and meter in the scullery.

In all three types of quarters the floor space of the living-room is 160 sq. ft., and the bedroom in the "A" type has a similar measurement, while in the "B" and "C" types the best bedroom measures 150 sq. ft., and the second bedroom 100 sq. ft., the third bedroom in the "C" type being 90 sq. ft.

My only adverse criticism of the new quarters now being built is that the space from floor to ceiling is only 8 ft., which conforms to the minimum and normal measurement followed by the Ministry of Health in the construction of working-class dwellings. The Department of Health for Scotland, however, more nearly supports my desire for a 9 ft. minimum. In their two-story cottages they provide 8 ft. 6 in. on the ground floor and 8 ft. on the upper floor, while in flatted or tenement houses of two or three stories they provide 8 ft. 6 in. on all floors, and in certain instances 9 ft. on the ground floor. Bearing in mind the habits of the occupants, in my opinion, no matter how the windows are placed, anything under 9 ft. results in insufficient ventilation.

All quarters are now allotted not only according to the size of the family, but also according to the age and sex of the children. Having secured satisfaction in regard to the principle on which quarters are allotted and the hygienic aspect generally, the next thing was to see that sufficient quarters were provided of the appropriate sizes to meet the requirements of the soldiers' families as they actually exist in the average unit. For this purpose representations were made to the Quarter-Master-General's branch in regard to overcrowding, and a census of the families and quarters in different stations was taken in 1923 and again in 1930. As a result the proportion of "A," "B" and "C" quarters has been very materially altered so as to provide more adequate accommodation for the larger families found to exist by census.

The following table gives approximately the proportion of "A," "B" and "C" quarters existing in 1911 and provided in 1923 and 1931 in accordance with the census returns :—

	"A"	"B"	"C"
In 1911 Service units ...	60%	30%	10%
In 1923 ,, ,, ...	50%	35%	15%
In ,, Depots	40%	40%	20%
In 1931 Service units ...	45%	35%	20%

(4) *Feeding of the soldier.*—Of all the milestones to which I shall refer, none marks greater achievement than in the feeding of the soldier, and under the feeding I include not only the quality and quantity of his food, but also its cooking and service, the buildings provided for its preparation, and those in which it is eaten.

Diet.—An attempt to trace in detail the stages by which our present milestone has been reached would occupy several hours. I will skip the stages which intervene between 1660 and 1921. In the former year no food was provided for the soldier, and a Private of Foot was paid but 8d. a day, and from this sum he had to pay the innkeeper on whom he was billeted 4d. per diem for lodging, food and beer. In 1921 the Treasury accepted the principle that the public must be responsible for feeding the soldier, as is the practice in war. Here I would say, in passing, that no troops were ever so well fed in war as were ours during the World War, and no factor was of greater importance in maintaining a high standard of health and morale.

In 1921 the ration provided by the State consisted of three parts:—

(1) That issued in kind by the R.A.S.C.: Meat (frozen or fresh), 12 oz.: bread, 16 oz.; tea, $\frac{5}{8}$ oz.; sugar, $1\frac{1}{2}$ oz.; salt, $\frac{1}{4}$ oz.

Periodically, for the purposes of mobilization, turnovers of 9 oz. preserved meat and 12 oz. of biscuit are issued in lieu of the meat and bread ration, and on these days a small cash allowance is credited to the messing account for every 1 lb. of each conserved. Underdrawals of the R.A.S.C. portion of the ration are not allowed except in the case of bread. For every 1 lb. of bread underdrawn, 12 oz. of flour may be drawn in lieu for making pastry, cakes, etc.

(2) That supplied by N.A.A.F.I. at contract rates and on which no rebate is paid: Bacon, 2 oz.; cheese, 1 oz.; jam and syrup, $1\frac{1}{2}$ oz.; margarine, 1 oz.

(3) A cash allowance of $3\frac{1}{2}$d. In 1928 this cash allowance was reduced to 3d., but in 1931 a change of policy was introduced whereby the cash allowance now varied between a maximum of $3\frac{1}{2}$d. and a minimum of 3d. The allowance is reviewed monthly and is based on the cost-of-living index of the Ministry of Labour.

The cash allowance is made with the object of enabling units to buy such extra articles of food from the N.A.A.F.I. as will ensure the provision of a well-balanced and varied diet, containing all the essential constituents in proper amounts and proportions. The hygiene specialist must scrutinize, from time to time, all diet sheets exhibited in the cookhouse to satisfy himself that this object is achieved. The principal articles bought from the cash allowance are vegetables, milk, liver, fish, eggs and such like. Should the cash allowance prove inadequate for the purchase of these articles in sufficient amounts, units may commute for cash the cheese, jam, margarine, and up to 6 oz. weekly of the bacon, but commutation to any great extent under the existing system is not a wise procedure, nor is it made use of to any great extent, as the bacon, cheese, jam and margarine are bought at contract rates and provide excellent value for the money expended, whereas if these articles are commuted, the commutation is done at wholesale rates and fresh purchases have to be made at retail rates and result in a bad bargain.

Even the soldiers' Christmas dinner (New Year's dinner in Scottish Units) receives consideration nowadays, and a halfpenny for each man actually in mess may be taken from the units' credit balances and spent on this special Christmas meal.

As the result of recent propaganda much more whole fresh milk is now being used in substitution for tinned milk, and the milk supplied under contract to hospitals is pasteurized.

The peace-time diet which I have just described contains in sufficient amounts and in proper proportions the proximate principles—proteins, fats, carbohydrates, vitamins and mineral salts—and has an average caloric value of approximately 3,600 calories. That this diet is satisfactory is proved by the physique of the average soldier and the health of the Army, and by the improvement in the physical and mental state of the recruit at the end of his depot training. The average recruit gains 8 lb. in weight during that time, and many gain fully twice as much, while there is a marked advance in the standard of education of the vast majority.

The feeding of the territorial soldier and of the cadets of the Officers Training Corps while in camp receives careful supervision on similar lines to that exercised over the ration of the regular soldier, and has a value of over 4,000 calories.

When I was Assistant Director of Hygiene, Eastern Command, I observed that, notwithstanding the excellent organization and administration of the Duke of York's Royal Military School at Dover, the boys were stunted in growth. I therefore made a careful investigation of the feeding of the boys, and discovered that the dietary was lacking in several essentials for growth. As the result of my representations the feeding of these boys has been greatly improved by the inclusion of one pint of fresh whole pasteurized milk daily per boy. Eggs, fish, butter and a more liberal supply of fresh vegetables are also provided. The feeding of the boys in Queen Victoria's School, Dunblane, has been improved on similar lines, although, owing to extra cost, the milk is not pasteurized.

This year (1934) approval has also been obtained for each boy at the Army Technical School, Beachley, to receive a daily allowance of 5 oz. of whole fresh milk and 15 oz. of hand-skimmed milk.

Quality of food.—The quality of the different items of food forming the ration is controlled by means of carefully drawn up specifications, inspection by experts and analyses at the Central Reserve Depot and R.A.M. College, and also by the provision of suitable transport and storage facilities, including, in some hot stations, a supply of ice boxes and ice. The regulation of the supply of refrigerators and ice in all stations where the temperature normally exceeds 80° F., is at present under consideration.

Housekeeping.—An important subject, formerly neglected, which is now carefully supervised by the Inspector of Army Catering on behalf of the Director of Supplies, and is controlled by Unit Messing Committees which contain representatives of all ranks. It is also greatly facilitated by the training of officers and cooks at the Army School of Cookery.

Valuable guidance is obtained from various manuals, most of which are compiled by the Inspector of Army Catering and are issued to units. These include the Manual of Military Cooking and Dietary, the Management of Soldiers' Messing, Rules for the Conduct of Regimental Institutes, War Office Quarterly Specimen Diet Sheets, Army Book B. 48 with lift sheets, etc.

Cookhouse and dining-hall buildings.—All the more senior Army officers are familiar with the Army cookhouse as it existed about the time of the South African War. This type still existed in some barracks until fairly recent years, and consisted

of a small building situated between two barrack blocks. This building contained the cookhouse on one side of a central wall and the latrines on the other. There was no preparation room or proper store cupboards. One shallow sink only was provided in which vegetables, cooking pots and other dirty articles were washed indiscriminately. There was no servery, hotplate, dining hall, or wash-up room. The food, often badly cooked by untrained cooks and most usually consisting of a greasy stew, had to be carried a considerable distance to the barrack rooms, where it frequently arrived cold, to be eaten there. After the meal the crockery and cutlery were cleaned (*sic*) in a pail of luke-warm water, dried on the soldier's body towel and stored, until the next meal, along with his bedding or kit. Any bread or other food not used was stored in cupboards in the barrack rooms or thrown away into the swill tubs. What a change we find to-day! The whole of the buildings concerned with the feeding of the soldier have been redesigned, and now consist of a separate block containing: (*a*) Preparation room with suitable cupboards, food preparation benches, tables, deep sinks, etc.; (*b*) kitchen with up-to-date cooking apparatus, deep sinks in which to wash cooking utensils and, hung up in a prominent place the menu of the week, rules for cookhouses and a list of the cooks employed with particulars as to their health; (*c*) a cupboard outside the cookhouse for the cook's special clothing and ordinary uniforms: (*d*) a servery with hotplate; (*e*) a dining hall suitably heated, lighted, furnished and equipped; (*f*) a wash-up room with mechanical washers and cupboards in which to store the feeding utensils.

All these rooms are under one roof and communicate with each other, and in well-administrated units provide ample facilities for the efficient preparation, cooking and serving of excellent meals in pleasant surroundings.

All new barracks are now provided with this building, and in most of the older barracks an effort has been made by reconstruction to bring existing cookhouse buildings as nearly as possible into line with this plan.

Preparation and cooking of the food.—Although there is still a paucity of trained cooks in some units, an effort is now made to supply to each unit thoroughly trained cooks who have received their training at the Army School of Cookery. I have had the privilege of inspecting and sampling all varieties of food cooked by these men at the conclusion of their Course of Instruction, and I endorse the opinion I have heard expressed by eminent civilian experts, who very kindly judge the different items cooked under Army conditions at the end of the course, to the effect that the preparation and cooking have improved enormously in recent years and that the work of these cooks compares very favourably with that of expert civilian chefs.

First-class cooks now receive 6d. a day extra pay and second-class cooks 3d. a day from Army Funds, instead of from Regimental Funds as was the practice prior to 1934. As the result of having trained cooks and messing committees the everlasting stew is now a thing of the past, and the menus are well varied from day to day and week by week.

Serving of the food.—No matter how well food may be cooked, unless hot food is served hot and the meal is partaken in clean and attractive surroundings, little pleasure is derived from eating and much of the value of the food is lost. The hotplates now installed in the servery provide the means for keeping food and dishes warm and in most, if not all, units the other essential points receive careful attention.

(5) *Cleanliness of the soldier.*—Monck's Committee in 1855 recommended the introduction of ablution rooms and foot baths, but this recommendation was not acted on until much later.

When first provided, the ablution rooms were equipped with cold-water taps, slate benches and detached metal basins. These basins have now been replaced by fixed glazed earthenware or enamelled iron basins which are more hygienic, but hot water is not yet laid on, except in certain workshops. I hope before long this obviously hygienic necessity will be supplied to all ablution basins.

So far as I am aware baths first appeared in Barrack Synopsis in 1865 when slate slipper-baths were authorized on a basis of 1 per cent of the strength of the unit. The 1898 Synopsis showed hot and cold water laid on and the baths painted inside and out. In 1910 The Army Medical Advisory Board, as the result of a meeting of the Construction Sub-Committee, recommended the provision of 4 per cent combined foot and shower baths in addition to the 1 per cent slipper-baths. At the same time Major Horrocks, the hygiene representative on that committee, recommended that in each bath house one slipper and one combined foot and shower bath should be provided for N.C.O.s. These recommendations are in force to-day, but the fuel allowance rarely admits of more than one hot bath a week. In 1933 I proposed to the Army Hygiene Advisory Committee that, for private soldiers, all slipper-baths should be replaced by combined foot and shower baths on the grounds that shower-baths are much more hygienic than slipper-baths and are more economical in fuel and water, and because of the latter advantages, baths could be given more frequently than at present without increasing the cost, a very desirable procedure for combating scabies and other skin infections which are so closely associated with dirt, and which cause much absence from duty and consequent expense to the State. My recommendations are under consideration by the proper authorities.

Swimming baths are becoming more popular and are provided in a number of stations at home and abroad. We are at present engaged in making analyses of all Army swimming-bath waters at home, with the object of ascertaining the best means of purification. At present some are without any proper means of purification, while in others purification is carried out by means of filtration, chlorination or chloramination and aeration. Owing to the prevalence of middle-ear disease, no man with discharging ears is allowed to use Army swimming baths.

From these remarks it is clear that while we have made considerable progress on the road to cleanliness we have still some distance to go before we reach the desired milestone.

(6) *Mother and child welfare.*—No achievement is likely to prove of greater value to the married soldier and his family than the official recognition of Army Mother and Child Welfare Schemes and Centres. I had the honour of representing the Medical Services on the War Office Committee which threshed out this subject, and of pressing for the official recognition of Army Welfare Schemes, and was very gratified when approval of the schemes and the establishment of Welfare Centres up to a total of seventy was given in 1924.

The Treasury grant for the upkeep and running of the centres, viz. £6 per centre, with a little special furniture for centres established in official medical inspection rooms for women and children, is very small compared with that given to civilian centres, but by the aid of extra money raised by units very creditable centres have been established in most stations where they are required.

A special form, Army Form C. 320, is prepared for each child up to 5 years of age, and on this a confidential record is kept of all disabilities from birth up to school life, when the School Form, Army Form C. 319, comes into use.

Where the centres are properly run and advantage is taken of the services of the specialists in Districts and Commands, no soldier's child should grow up with a disability which is capable of prevention, alleviation or cure.

When the children reach school age and go to the Army schools, four sizes of school desks, constructed on hygienic principles, are provided for the older children, and two special sizes of chairs and tables for infants, with the object of preventing postural deformities, and every attention is given to the lighting, ventilation and other amenities in the schools to ensure good eyesight and general good health.

In regard to the mothers, the ideal aimed at is close coöperation between the centres and military families' hospitals. The specialist in women's diseases, where available, gives ante-natal and post-natal advice at the hospitals. All women are encouraged to come into hospital for their confinements, and most do so, with the gratifying result that, whereas the maternal mortality in the civil community is in the neighbourhood of 4·5 per 1,000 of confinements, in the Army during the latest three years for which figures are available—1930 to 1932—it has only been 0·37, 0·71 and 0·37 per 1,000 respectively.

Instructions given by the specialist in regard to the ante-natal and post-natal periods are carried out at the centres and also in the soldiers' homes, under the supervision and guidance of nurses belonging to the Soldiers', Sailors' and Airmen's Nursing Association. The centres are run by committees composed of the wives of all ranks under the special supervision of medical officers, assisted by the nurses. At the centres, in addition to medical examinations, weighings, &c., valuable advice and instruction are given in regard to feeding, clothing, upbringing of children, and other useful matters, and special infant foods are sold at reduced prices.

I need say no more to convince you of the value of this organization from the health aspect, but it has also another very important use in that it brings together the wives of officers and other ranks and creates a friendly interest between them, which goes a long way in fostering a contented and happy unit and military community.

(7) *Supervision of physical training from the physiological aspect.*—An important milestone in Army training was reached in 1922 when the first Hygiene Specialist was appointed to the Staff of the Army School of Physical Training, to supervise that training from the physiological aspect and to carry out research in regard to this aspect of physical training. The officer appointed to this post receives special training in physiology in the Hygiene Department of the R.A.M. College, a course of experimental physiology under Professor Cathcart in Glasgow University, and passes through special courses of physical training at the Army School before taking up the appointment. Since the post was created the duties of the incumbent have been increased, and now include the teaching of anatomy and elementary physiology to officers and prospective physical training instructors, and also of first aid and remedial exercises to the latter. He is also in medical and sanitary charge of the school. Much valuable research has been done by these hygiene specialists in regard to (1) the effects of smoking on endurance and on short bursts of energy as in sprinting; (2) the energy expenditure entailed in the physical training exercises at

present in use; (3) exercise tolerance before and after training; (4) strength of grip before and after training; (5) effects of abdominal breathing on vital capacity, &c. Stated very briefly, this research has proved that smoking is detrimental to endurance, but does not seem to affect sudden bursts of energy as called for in sprints. The energy tests showed that our present exercises and tables, although selected and arranged as the result of experience but more or less empirically, are, on the whole, arranged in the proper order of progression as regards energy expenditure, and are admirably suited for the production of high mental and physical standards. Exercise tolerance and grip both improve in a satisfactory manner as the result of the training received and deep abdominal breathing gives a greater increase in vital capacity than the customary chest breathing.

A recent innovation, which will have a valuable bearing in the supervision of physical training in units and depots from the medical aspect, is the introduction of special courses at the Army School of Physical Training for all R.A.M.C. officers on joining the Service and for Hygiene Specialists.

In the Field

(8) *Intelligence.*—Under this title I wish to deal particularly with Military Medical Intelligence, and I am sorry to say that we have not yet reached that milestone on the road to success which is desirable if we are to avoid the errors and losses of previous campaigns. To achieve success in dealing with health problems it is essential to know what problems you have to face, and to have schemes ready for application at the commencement of a campaign. With this object in view one of the first things I asked my Director to allow me to do when I joined the Hygiene Directorate in the War Office in 1923 was to build up a Hygiene Intelligence Bureau from which could be obtained reliable and up-to-date information in connexion with all matters likely to affect the health of troops in any country. He welcomed the suggestion, so I interviewed the Director of Military Intelligence and the officer responsible for the military handbooks and through these officers formed a close liaison with the Intelligence Branch. I drew up for the branch a pro-forma setting forth the various headings under which we desired to obtain information and on which the special chapter dealing with such matters in these handbooks should be based. I also suggested that we could get much valuable information through the Army Intelligence representative on the League of Nations and the Ministry of Health representative on the Health Bureau of the League. These suggestions were all agreed to and are in operation to-day. We obtain from the annual and other reports of hygiene specialists reliable information of the nature required in regard to those parts of the Empire in which these specialists are stationed, and while officers of the intelligence branch serving in different countries do their utmost to help us, the technical nature of the medical information we require makes it extremely difficult, if not impossible, for the latter to provide us with this information, and I often wonder if we have gone far enough or whether we should not have a hygiene specialist in the Intelligence Branch.

(9) *Feeding.*—To overcome the monotony of the daily stew or of cold bully beef has always been an important and difficult problem in the field, but it has now been solved by the introduction of travelling cookers using petrol or other form of oil,

and by the description in the Army Manual of Cooking and Dietary of many different ways of cooking field rations.

(10) *Drinking-water.*—Those who have had experience in the field since the introduction by Colonel Sir William Horrocks in 1914, of the chlorine method of purification of water, which must have saved many lives and prevented much sickness, while appreciating the value of that method, must also have been aware of its disadvantages in regard to the instability of the bleaching powder used, the deviation of the chlorine in the presence of organic matter, and the unpleasant taste imparted to the water and to tea by the chlorine when the process was not very strictly controlled. In order to overcome the instability of the bleaching powder, this powder was replaced in 1921 by the more stable "Water Sterilizing Powder" containing a mixture of quicklime and bleaching powder. This change was introduced chiefly as a result of investigations carried out by Major Elliott at the R.A.M. College.

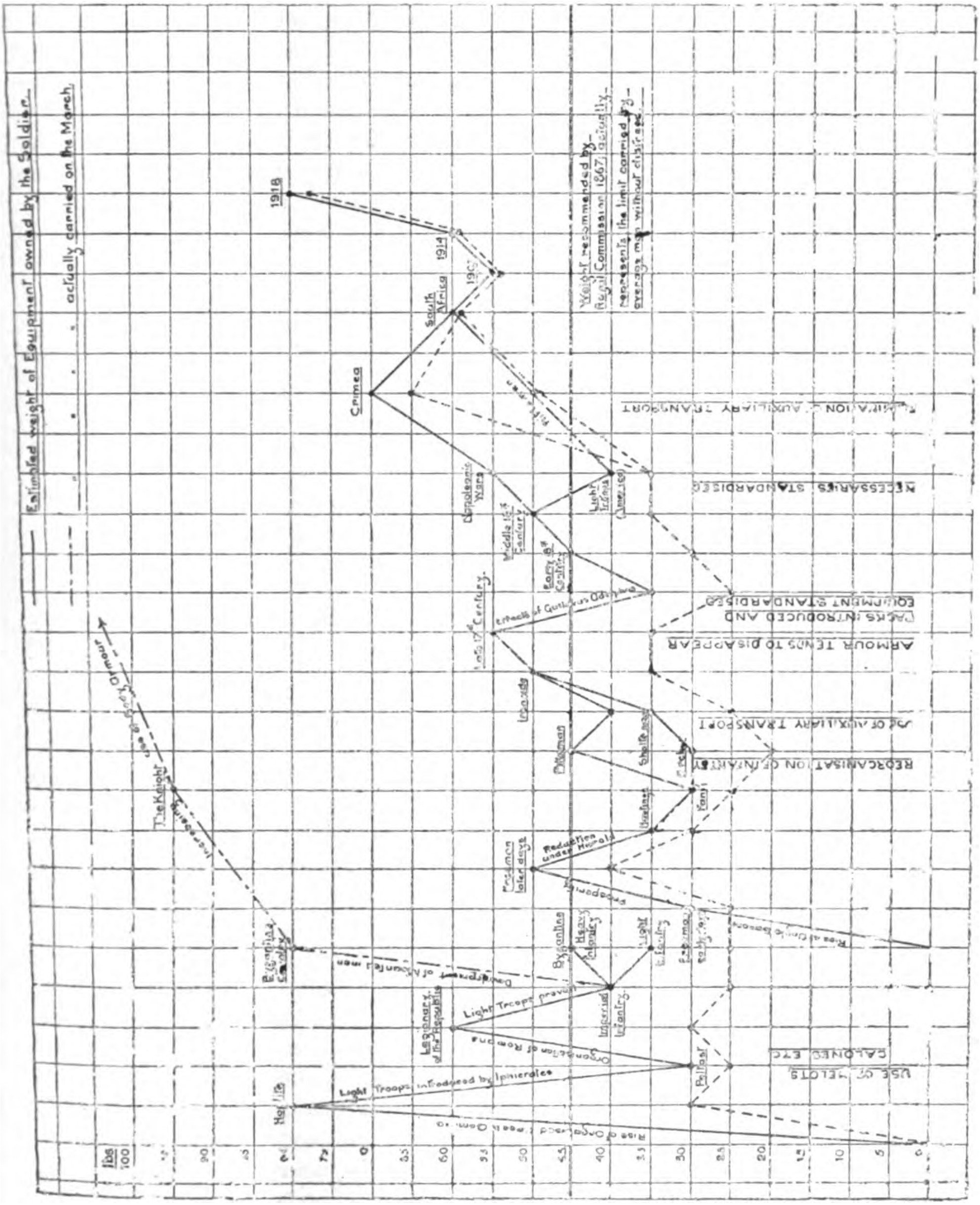
In 1922, Major Harold and Captain Ward commenced their important work at the Army School of Hygiene on chloramines formed by the interaction of chlorine and ammonia. Captain Ward having left the School, Major Harold continued the investigation and in 1924 and 1925 he published the results of this most valuable piece of research, recommending the substitution of chloramine for chlorine in the purification of water in the field.

He got better results with preformed chloramine than with bulk-formed chloramine, but as the production of the preformed variety entailed the use of sparklets containing chlorine gas and a syphon, Major McKibbin continued the investigation at the School in the hope of devising a simpler process, and succeeded in getting good results in purification with *bulk-formed* chloramine. This process had the practical advantage over Harold's method of doing away with the necessity for extra apparatus. In 1931, Major Elliott, acting on the above principles, devised an admirable purification plant erected on a platform and carried on a motor chassis, with a total weight of about one ton. This plant is known as the "Elliott Mobile Water Purifier" and is capable of drawing water from a depth of eight feet, chloraminating and filtering it, and delivering it to tanks to a height of twenty feet, at the rate of 1,200 to 1,500 gallons an hour.

In Elliott's Purifier chlorine is produced by the electrolysis of salt water. He and McKibbin found that best results are obtained by using ammonia and chlorine in the ratio of 1 to 4, and that for practical purposes in the field the chloramine should be applied to the water in the proportion of two parts per million. Using this strength a safe and tasteless water is obtained after one hour's contact. In this concentration also chloramine has the advantage over chlorine of killing the cercariæ of bilharzia in clarified water in half an hour and in crude water in one hour. Elliott's and McKibbin's methods of purification have been tried out during manœuvres under active service conditions, with satisfactory results. McKibbin's method has also been tested in Egypt with equally good results.

(11) *Clothing and equipment.*—Those of us who served for a prolonged period with front-line troops in the World War observed how greatly handicapped our marching units and particularly our infantry were by being overloaded, and by the unsuitable nature of their uniforms, which constricted the neck, interfered with the circulation of the blood and with the free circulation of air around the body. The

combination of these factors induced men to discard essential parts of their equipment or produced early fatigue, with the result that they could neither fight to the best advantage nor adequately defend themselves. As a result many were



MAJOR LOTHIAN'S CHART.

killed or wounded who, if they had been properly clothed and equipped, would doubtless have fared very differently. Many men also succumbed to "trench foot," a disability induced, to a great extent, by tight wet puttees.

The Hygiene Directorate took up this matter soon after the War.

In 1921, Major Norman Lothian, a most able officer of the Directorate, who, later, when Secretary of the Health Bureau of the League of Nations, met an untimely death through a motor accident in Palestine, compiled a brilliant treatise on the load of the soldier, and traced the vagaries of that load from the early days of the Greeks and Roman Legions through history up to and including the period of the World War. The striking lesson which Major Lothian's pamphlet taught was that we had failed in most of our wars to benefit from previous experience.

It usually happened that at the end of a war it became obvious that the soldier was carrying a too-heavy burden, and when the war was finished an attempt was made to reduce the fighting load, but the lesson was soon forgotten and when the next war was declared the infantry soldier was again converted into a beast of burden.

Time will not permit me to traverse the ground covered by Major Lothian, so I will merely refer you to his chart on p. 13 and confine my remarks to the South African and World Wars. During the South African War the load was about

TABLE

Animal	Body-weight		Load	Percentage of body-weight
Elephant	7,840 lb.	...	1,100 lb.	14%
Camel	1,120 lb.	...	300 lb.	22%
Cavalry (horse) ...	1,100 to 1,150 lb.	Rider Equipment	150 lb. 115 lb.	24%
Mule	700 lb.	...	170 lb.	24%
Pony	700 lb.	...	170 lb.	24%
Bullock	700 lb.	...	170 lb.	24%
Donkey	450 lb.	...	100 lb.	22%
Man (coolie)	?	...	40-50 lb., but no fighting is required in addition to porterage	
Soldier	130 lb.		55 lb. 6¾ oz.	42·7%

60 lb. and the soldier usually discarded a good deal of it, so an attempt was made later in the campaign to provide a special load of 25 lb. Following the war there was a revision of the equipment, and in 1907 the standard load was reduced from 60 to 54½ lb. In 1908 web equipment was introduced and the load went up to 59½ lb., and during the World War this load mounted up to 80 lb. in winter, and sometimes it actually reached 100 lb., an impossible burden for any animal of the weight of the average man. The table above shows the body-weight and load of various animals and man. After the issue by the Hygiene Directorate of Major Lothian's treatise to the General Staff and other branches concerned, the Hygiene Directorate next took up the questions of (*a*) the energy expenditure of the soldier under certain loads and (*b*) the energy value of the ration. Research in regard to these important matters was undertaken by Professor Cathcart and officers of this Directorate, and their investigations were submitted to and considered by the Army Hygiene Advisory Committee in 1923. In regard to the load it was proved that the economic load of the soldier was approximately one-third of his body-weight.

The investigation of the energy-value of the ration gave a clear guide as to the calorie value of the ration required for the soldier's work under different conditions,

and also as to the adequacy of the ration, tested as regards calorie value, for the work the soldier was performing.

Next followed experiments by the Hygiene Staff of the R.A.M. College to ascertain the best type of pack and the best position on the body on which to carry it. As a result the two-piece pack carried high on the shoulders, with steadying straps passing under the arms and quick release fastenings, was recommended. After that an investigation was carried out by the Hygiene Staff at the College in conjunction with Major Johnson, R.A.O.C., with the object of devising a more hygienic uniform for field service. The proposals of these officers were submitted to the Army Hygiene Advisory Committee for consideration, and the final recommendations of that Committee were forwarded to branches concerned and published in the Annual Health Report of the Army. As a result the C.I.G.S. ordered Commands to investigate the matter and submit recommendations.

When these were received the C.I.G.S. ordered the formation of the Braithwaite Committee, and gave the Committee instructions to consider the various reports and recommendations and decide on a suitable dress and equipment for the soldier for use on manœuvres and active service. Walking out and ceremonial dress was not to be considered. This Committee's choice, in most essentials, coincided with the recommendations of the Hygiene Directorate.

The new uniform and equipment has been on trial with two regiments since 1932, and reports so far are most favourable to the equipment, the hat, jacket with open collar, and the shirt with fixed collar, worn over the jacket collar to keep the latter clean. The wide peg-top trousers are preferred to the long shorts. No decision has yet been reached by the units in regard to the canvas gaiters owing to the very dry season and absence of mud. The short puttees, as expected, were found to be unsuitable.

(12) *Disposal of cookhouse sullage water and soapy water from baths.*—The efficient disposal in the field, during field training and in war, of these waters has always been a source of great trouble, owing to the soakage pits becoming blocked by a lining of grease or soap suds. After prolonged research by Major Hattersley at the Army School of Hygiene the problem would appear to be solved, for it is found that by adding copperas (ferrous sulphate) and lime to these waters, the grease and soap are deposited in a heavy precipitate in a very few minutes and the clear supernatant fluid can then be run off.

(13) *Disinfection in the field.*—A disinfector, using downward displacement current steam, suitable for unit use and capable of being transported on a pack animal, has now been tested and proved satisfactory. It was devised by Major T. O. Thompson at the Army School of Hygiene and fills a much-felt want.

(14) *The use of aluminium foil in the regulation temperature.*—Last year we had the privilege of listening to an address by Major Crowden, of the London School of Hygiene and Tropical Medicine, on his discoveries in regard to the properties of aluminium foil in reflecting and in preventing the radiation of heat, and the practical application of his discovery to the reduction of temperatures inside helmets, huts, tents, food containers, ambulance cars, etc. In the recent very hot summer he was able to carry out a field trial of his device during the annual training camp of the London University O.T.C. in the Isle of Wight, in regard to its application to food

containers and tents. As a result he saved, in a fortnight, between £4 and £5 on the usual expenditure on ice alone by an initial outlay of £1 on foil. Food was easily preserved from deterioration, and the insides of tents where foil was applied, instead of being almost unbearable from the excessive heat, were compared to the shade of a tree covered with thick foliage. The importance of his discoveries and their practical application in many directions in peace and war are very great.

Did time permit I could bring to your notice many more achievements in the field of hygiene but I hope my survey has been sufficiently comprehensive to show that we are achieving satisfactory results in many important directions.

SANDFLY FEVER ON THE INDIAN FRONTIER.

A Preliminary Note on Some Laboratory Investigations.

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(*Continued from p.* 367, *vol. lxiii.*)

(7) *Experimental animals are immune to the disease.*

We have no conclusive evidence to offer either for or against this statement but certain of our experiments would appear to suggest that at least in the case of monkeys it may be possible to reproduce the disease by inoculation.

The experiments conducted by us consisted in passaging human blood of sandfly fever cases into monkeys (*Macacus rhesus*), and monkey blood into humans and monkeys. For convenience these different experiments will be considered *seriatim* in the groups indicated above but, befere doing so, it will be necessary to make a few remarks on certain fallacies which had to be guarded against and various factors which had to be taken into consideration in interpreting our results.

In a disease such as sandfly fever, where one is dependent for diagnosis on clinical signs and subjective symptoms, it is essential that these signs and symptoms should be typical and unequivocal before the assertion is made in any particular case that the condition induced as the result of a certain experiment is really sandfly fever. When one is dealing with animals the subjective symptoms are ruled out as unascertainable and diagnosis has to be made on clinical signs alone. This would be fairly satisfactory were they present in typical form and degree, but if we are dealing with an animal but mildly susceptible to the disease, it is likely that the signs as well as the symptoms will be modified in kind or degree or both. This is the less remarkable when we consider that in man himself, who is highly susceptible to sandfly fever, modified attacks may and do occur. It is on account of these considerations that we lay no claim actually to have transmitted the disease to monkeys but merely point out that some of our experiments suggest that such was the case, albeit the disease was mild in degree and the signs more evanescent than in the more highly susceptible human being.

The main factors on which we had to rely in making our diagnosis in the case of monkeys were the temperature and the incubation period and the latter had to be gauged by the former alone.

Two of us have had a very large experience of dealing with monkeys owing to the numbers used by us in experiments in connection with rabies, and we were therefore fully cognizant of the variations in temperature exhibited by monkeys and considered it essential to include an elaborate system of controls in our experiments. To do this we decided to take all the temperatures at the same hour each day, to take the temperatures of normal monkeys at the same time, and to employ control monkeys into which normal monkey and human bloods had been inoculated in the same amounts as the infected blood into the experimental monkeys. In addition, the temperatures of twenty normal monkeys were taken at the same time in order to establish a provisional mean normal temperature for the time of day and other conditions prevailing.

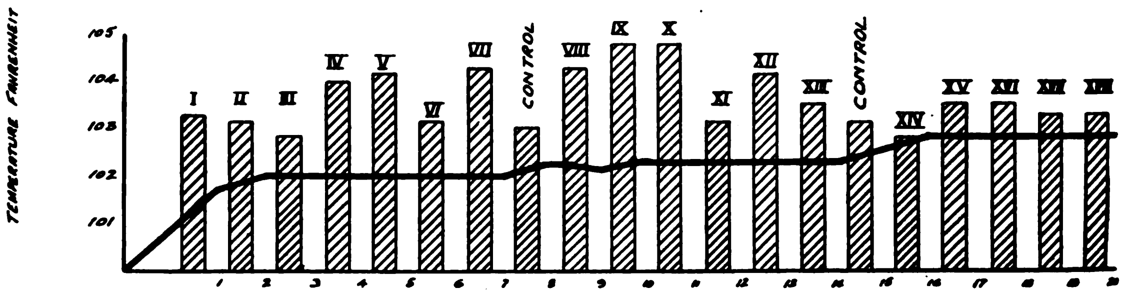

CHART 3.—Roman numerals = Experimental monkeys I to XVIII; Arabic = Twenty normal monkeys: Continuous line = Temperatures of 20 normal monkeys taken at the same hour on one day; Columns = Maximum temperatures of monkeys I to XVIII and controls.

The continuous bold line in Chart 3 shows graphically the temperatures of twenty normal monkeys taken at the same time of day (4 p.m.) superimposed on the maximum temperatures of eighteen of the experimental monkeys used in this investigation. It will be seen that the variations of the normal temperature lie within one degree Fahrenheit. The average temperature of these twenty monkeys taken at the time stated was 102.3°F.

Experiments in which Human Blood of Sandfly Fever Cases was Inoculated into Monkeys.—The human blood specimens used in these experiments were in some cases sent from Landikotal or Peshawar and had therefore undergone a three-day exposure to the heat of the plains as well as a long railway journey. In other cases the specimens were freshly drawn blood from cases of sandfly fever induced in Kasauli by inoculation of the Peshawar bloods.

The only clinical indication available of successful infection of the monkeys was a rise of temperature which persisted for some time above the point considered the daily maximum under normal conditions. As a

control against the possible thermogenic effect of inoculation of blood alone certain controls were given inoculations of normal human blood. This was found actually to cause a slight rise of temperature and therefore cases in which supposedly infective bloods caused no greater rise than in these controls were not looked upon as positive results. This, however, does not rule out the possibility that their blood may have contained the virus, as certain of our results seemed to indicate this as a possibility. Thus, the blood of monkeys I and II in which the temperature rose only slightly above 103° F. (although this was higher than the normal human blood control monkeys) produced definite fever in monkeys IV, V, and VII and therefore presumably contained the virus.

Using, then, temperature as our criterion we found that out of 11 monkeys inoculated with the blood of sandfly fever cases 5 contracted definite fever, while 6 showed no fever or only a transient rise as compared with the control monkeys which received an inoculation of normal human blood.

In combined Chart 4 we have given the temperatures of these five monkeys which appeared to show a definite short fever of greater degree than would be caused by injection of normal human blood alone. The temperature chart of a monkey receiving an equal amount of normal human blood is also given for comparison, and, as a background to the charts, the provisional normal temperature for monkeys is given as a straight line at 102·3° F.

A glance at the individual charts will show that there is a distinct difference between the temperatures of monkeys VIII, IX, and X and that of the control monkey, but much less in the case of monkeys I and II.

The incubation period appears shorter than in the case of similar experiments with human beings but it has to be remembered that a much greater volume of blood relative to body weight was inoculated in the case of the monkeys.

Experiments in which Supposedly Infective Monkey's Blood was Inoculated into Monkeys.—Seven experiments were carried out in this series. In each case the monkey received into the loose tissues of the abdomen 5 cubic centimetres of freshly drawn blood of a monkey infected from a human case. Three out of the seven monkeys became infected judging by the criteria laid down by us for the animal experiments.

The charts of these monkeys are given in combined Chart 4 together with the chart of one of the control monkeys inoculated at the same time with the same amount of normal monkey blood.

It will be seen that there is an incubation period of three or four days and that the fever lasted for one to five days. The control monkey showed the relatively small rise of temperature which has been previously mentioned.

Experiments in which Supposedly Infective Monkey's Blood was Inoculated into Humans.—Three such experiments were carried out. In each

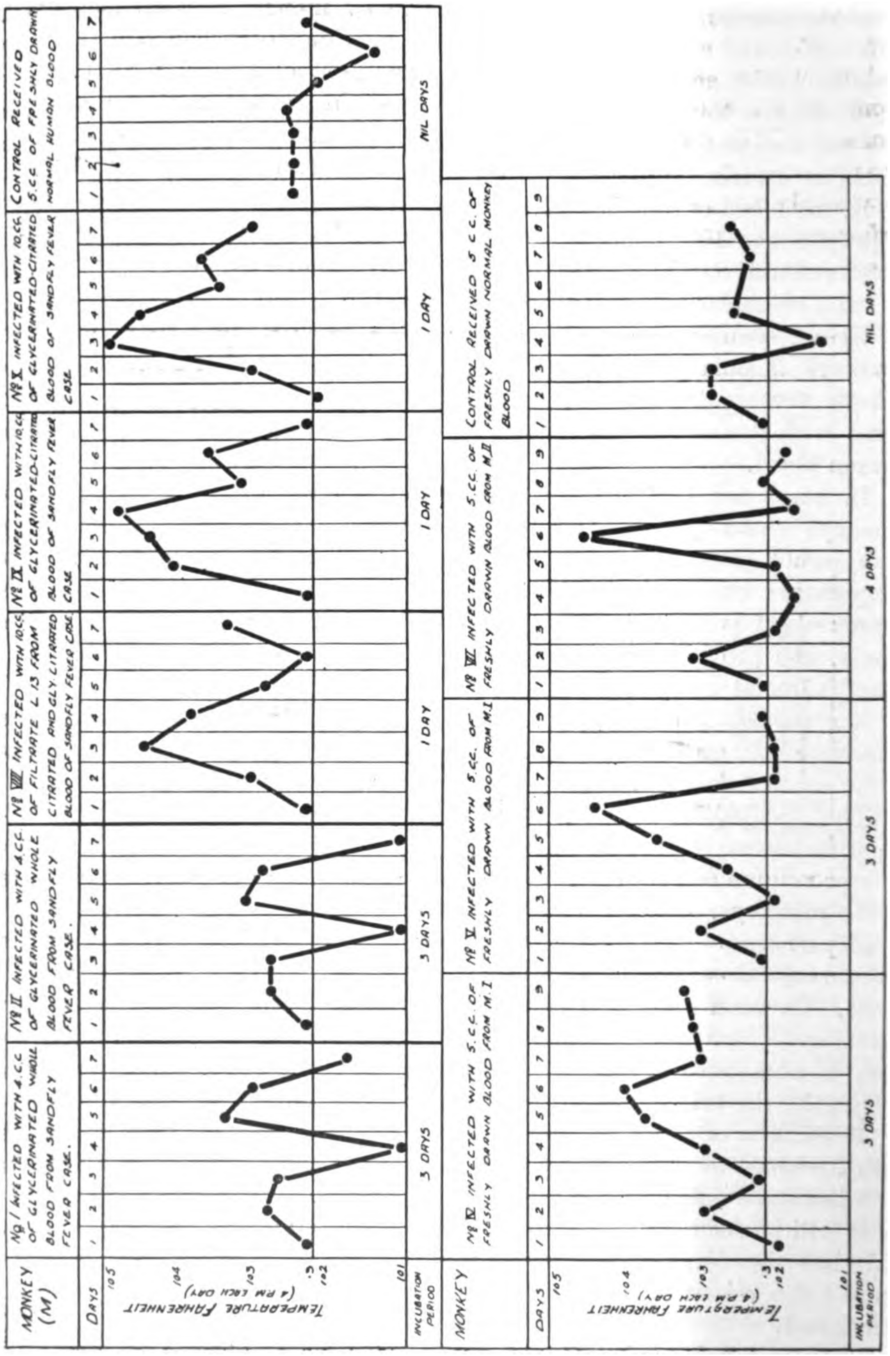

CHART 4.—The temperature charts of monkeys infected by inoculation of human and monkey infective blood.

case the monkey used had been infected by means of blood sent from Peshawar. In two of the cases 10 cubic centimetres of citrated-glycerinated blood, sent as such from Peshawar, was used for infecting the monkeys (monkeys IX and X). In the third case the infection of the monkey (monkey VIII) was brought about by 10 cubic centimetres of a filtrate through an L13 Chamberland candle of a mixture of citrated blood and citrated-glycerinated blood of the same individual. The filtration was performed in Kasauli after receipt of the bloods from Peshawar. All these monkeys became infected, as judged by the criteria for infection in

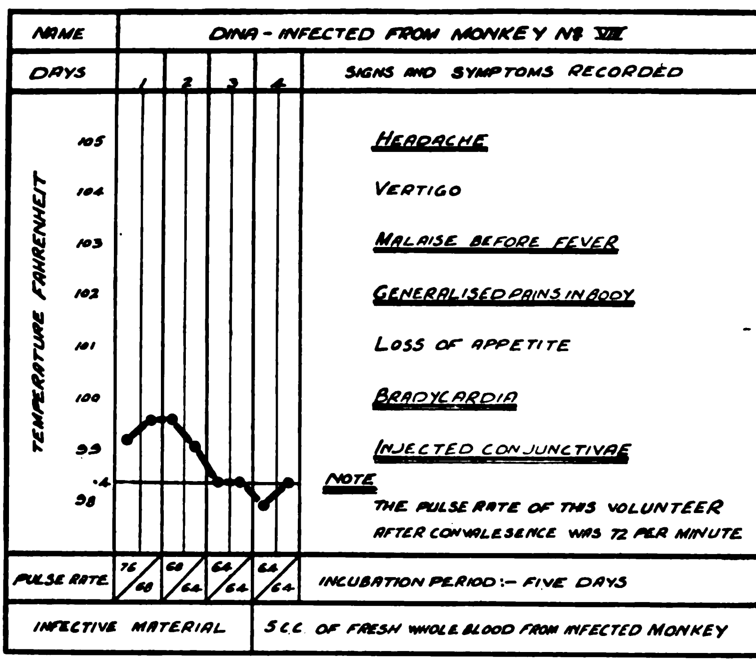

CHART 5.—Sandfly fever induced in human volunteer by inoculation of infective monkey's blood.

animals we have already discussed. The temperature charts are shown on combined Chart 4. From each of these monkeys 5 cubic centimetres of freshly drawn whole blood was inoculated into a human volunteer in the loose tissues of the abdomen.

In two cases the results were negative as regards rise of temperature. One of them complained of headache and vertigo on the sixth day from the date of infection—temperature normal. The next day he complained of headache and pain at the site of inoculation. The symptoms cleared up on the third day. The other complained of headache and vertigo on the seventh day after infection—temperature 98·8° F., pulse 88—site of injection swollen and tender. Cleared up next day.

In the third case the volunteer contracted a definite, though modified, attack of sandfly fever as will be seen by a reference to Chart 5.

Apart from the low temperature in this case the other signs and symptom of sandfly fever were quite typically manifested. In recording our findings in the human cases we adopted, at the beginning of our experiments, a *pro forma* which included all the signs and symptoms of sandfly fever described by various observers or seen in our own experience. A part of this *pro forma* is given with Chart 5 completed for the patient in question as an indication of the completeness of the evidence that the case really was a mild case of sandfly fever.

In the *pro forma* the signs and symptoms which we consider most important in the diagnosis of sandfly fever are underlined and it will be seen that most of these were shown by the patient. The incubation period was five days and the duration of the fever three days. Malaise, headache and injected conjunctivæ were marked symptoms. Extremely characteristic was the slow pulse which maintained a low level throughout the fever and for some days afterwards. The pulse rate of this individual has since returned to its normal rate of seventy-two per minute.

The fact that the attack was a comparatively mild one may have been due to the attenuation of the virus by passage through a monkey but, on the other hand, it may have been due to a relative immunity, for several of our volunteers who were inoculated with infective human blood complained of malaise and vague muscle aches yet did not actually develop fever and so have been put down by us as failures in infection.

To exclude the possibility that the inoculation into human subjects of normal monkey blood might produce the results recorded in these cases, two human controls were each inoculated in a manner similar to the volunteers with five cubic centimetres of freshly drawn normal monkey blood. The temperature, pulse and symptoms were recorded daily for one week. There was no rise of temperature and the only complaint was slight tenderness at the site of inoculation on the day following the operation.

(8) *No visible causative agent has been demonstrated in the blood by direct microscopical or cultural examination.*

In all the typical cases of sandfly fever induced by us in Kasauli the blood was very carefully examined microscopically. With the exception of one case which will be mentioned in the next section no visible micro-organisms were encountered. The freshly drawn blood of six of the induced cases was cultured in Fletcher's medium. Six tubes of medium were inoculated from each case, about 0·75 cubic centimetre of blood per tube being used. In no case was any causative micro-organism demonstrated and the cultures remained sterile.

(9) *A Leptospira has been isolated from cases of so-called sandfly fever.*

As stated in the last section the bloods of all the cases of sandfly fever induced at Kasauli were carefully examined. In one stained blood slide

from volunteer No. 28 a single definite spirochætal organism was seen. Further slides taken from the same case failed to reveal any more organisms. Inoculation of blood into Fletcher's medium had been carried out at the same time at which the blood slide was made. These cultures remained sterile. It was thought that the most probable source of the single organism was the distilled water used in diluting the Leishman's stain used. A sample of the water in the bottle was centrifuged and the deposit stained and examined. Scrapings from the stopper of the bottle were similarly examined and the samples were also examined by dark-ground illumination. These examinations showed the presence of a variety of bacteria and, although no leptospira was noted, it is considered that the water was the probable source of the one specimen seen in the stained blood slide.

Summary and Conclusions.

(1) Blood specimens of sandfly fever cases from the Indian Frontier sent to Kasauli produced typical sandfly fever in human volunteers when inoculated subcutaneously.

(2) Fresh blood from a locally induced case in Kasauli produced typical sandfly fever in another volunteer when inoculated subcutaneously.

(3) Fresh whole blood, citrated whole blood, glycerinated whole blood, citrated glycerinated blood and filtrates of blood were all found capable of inducing the disease by subcutaneous inoculation.

(4) Inoculation of infective human blood appears to have induced sandfly fever in monkeys.

(5) Inoculation of infective monkey's blood appears to have induced a mild but definite attack of sandfly fever in a human volunteer.

(6) Inoculation of infective monkey's blood appears to have induced sandfly fever in monkeys.

(7) The bites of sandflies fed on cases of sandfly fever on the Indian Frontier appear to have induced attacks of sandfly fever when fed upon volunteers in Kasauli.

Acknowledgments.

In conclusion, we desire to express our thanks to Colonel E. W. C. Bradfield, C.I.E., O.B.E., I.M.S., Assistant Director of Medical Services, Peshawar District, for the great interest taken and assistance given by him in this preliminary investigation. Our thanks are also due to Colonel I. M. Macrae, C.I.E., O.B.E., I.M.S., Officer Commanding, Indian Military Hospital, Peshawar, Lieutenant-Colonel A. Campbell Munro, M.D.(Glasg.), D.P.H., D.T.M.(Camb.), I.M.S., Officer Commanding, Indian Military Hospital, Landikotal, and Lieutenant-Colonel T. H. Scott, D.S.O,, M.C., M.B., R.A.M.C., Officer Commanding, British Military Hospital, Peshawar, for putting at our disposal all the clinical material required in the investigation.

To Captain A. Sachs, M.B., R.A.M.C., we are greatly indebted for the laboratory facilities provided by him at the District Laboratory, Peshawar. It should be noted here, also, that it was due to investigations carried out by this officer in the previous year that the researches on sandfly fever were instituted by the Army medical authorities.

Dr. I. M. Puri, M.Sc.(Punjab), Ph.D.(Cantab.), F.E.S., who was working on the sandfly investigation under the Indian Research Fund Association, was of the greatest assistance to us and, by supplying us with laboratory-bred flies and arranging for the feeding of these on cases of sandfly fever, rendered possible the work on transmission by the bites of the flies.

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THE DOCTOR'S WAR, 1899-1902.

BY D.A.D.M.S,

(*Continued from p.* 105, *vol.* lxiii.)

I had no regrets in departing from Modder River. The hot weather was now reaching its highest point, the camp was rapidly becoming a dust heap and life was very dull. Also typhoid fever was rearing its ugly head with the plague of flies which spreads the disease. Flies became worse and worse, persistent, exasperating, maddening, damnable. I do not know anything to beat the South African fly. I suppose this is due to the fact that though hot the temperature is not high enough to discourage the fly as happens in Northern India. In 1899 the Army had no mechanical transport, and thousands of horses, mules and oxen swarmed over the ground. Each unit was responsible for the cleanliness of its lines, and so far as I remember there was continual action in burning and burying human and animal excreta and refuse. There was no sanitary section and no A.D.H. or D.A.D.H. to organize and inspect. I can only think of the P.M.O.'s Secretary as a Medical Staff Officer likely to function as adviser on health matters to the General Staff; whether he did so I have not the faintest idea. I know O.C.'s Field Hospitals were S.M.O.'s for their various sections of the camp, and I presume they were responsible to the P.M.O. At any rate sanitary conditions were much better at Modder River in 1899 than on the Marne-Aisne advance in 1914!

At the end of January, 1900, I was ordered to join a mounted Infantry Brigade as medical officer. I left Modder by train and travelled back to Orange River, the place we had started from a couple of months before on the march to relieve Kimberley. I noted with great interest the stations at Belmont and Graspan, sites of recent battles. Now they looked comparatively peaceful, though defended by a guard, and protected by sandbags and barbed wire. There I saw for the first time a species of officer to become famous all over the Empire; I mean the R.S.O. as I think he was called then, *not* R.T.O. The railway staff officer was in reality a worried and probably overworked individual, but for some reason he acquired in the South African War a reputation for holding a "cushy" job, being oblivious to the discomforts and trials of the travelling soldiery, and displaying in himself an arrogance of dress and deportment infuriating to the troops. To see a R.S.O. wearing spurs was considered the last straw (though why the unfortunate officer should not ride a horse for exercise was overlooked), and a General Officer notorious for his pithy sayings was heard to roar at one poor R.S.O. in these words, "Your blasted train's jibbing this morning. What!" On arrival at Orange River I hunted about for my M.I. Command. Finally I made for a hutted hospital and interviewed the O.C. He told me my people were in camp some miles away and advised staying the night with him and he would

arrange to send me out in the morning. I gratefully accepted this kind hospitality; in point of fact I was feeling very lost and rather dismal at the prospect of joining a new unit. After dinner the host started a long conversation with his fellow Major on the prospects, or otherwise, of promotion accelerated by war service. I was much too young to take any intelligent interest in this engrossing subject and was much relieved when the senior Major said, "What about you, young fellow, want to turn in?" I murmured, "Yes, I think I would, please." And the good-natured O.C. called up a N.C.O. and handed me over to him with some remark about "No. 10 Ward." Soon I found myself in a dimly lit wooden hut with rows of beds on each side. I was given a bed and turned in at once. That was the last bed I was to sample for many a long month. I was drowsily aware of some murmuring and talking during the night. Early awake I saw an orderly passing from bed to bed. When he came to me he seemed rather surprised to see me and asked when I had been admitted? I told him of the N.C.O. of the night before and how I had been conducted here. He seemed more surprised. He then said, "If I was you, sir, I would get up and go over to the Officers' Mess; this is the Enteric Ward you are sleeping in!" I took his advice and made a rapid exit.

I found my new home situated on the side of a small kopje some three miles out of the Orange River Station. The M.I. Unit was formed of companies from various infantry battalions turned into mounted troops and retaining the name of their own regiments. I was attached to the K.O.Y.L.I. Company for "accommodation and rations." The former consisting of my own valise for sleeping in and the wide and empty veldt for a bedroom. The latter a share in the mess property in the shape of some tin mugs and plates, a small portable table and a camp stool to sit upon. The Officer Commanding had an agreeable whimsical manner, distinguishable by wearing a single eye-glass without a rim or cord, and when mounted he carried an eye-glass screwed into a holder fixed in the khaki helmet. This gadget could be manipulated so as to cover his eye comfortably. Having been fitted out with a horse and groom I overhauled my medical equipment, consisting of a medical and a surgical pannier carried in the Scotch cart, and the medical companion (known as the "Hairy Companion" on account of the hairy hide covering), carried by my medical attendant, a corporal detailed from the unit to act as my assistant, and officially called the "Sick Corporal"; I was then ready for anything. Our stay at Orange River was uneventful. The only interesting thing I can recall is the visit paid us by a famous war correspondent. Strange as it may seem in these days the visit of this gentleman was treated as rather an alarming incident, and we were all warned against saying anything that "could be used in evidence against us," so to speak. I imagine our visitor was solely engaged in finding out something about this new kind of soldier the British Army was producing, "the mounted infantry man." The reason for his introduction into the war was, of course, the fact that our friends,

the enemy, formed an entire army of mounted infantry. A little matter of some 60,000 men prepared to ride anywhere at a moment's notice, requiring little or no transport, good shots and good horse-masters. Prepared to fight on foot or fire from the saddle—second nature to men who hunted and shot for the pot almost daily. Such an army, backed by the most modern artillery obtainable in Europe trained by continental experts, was a formidable opponent in a vast country of rolling plains, seamed with rocky outcrops leading to great mountain chains and passes, and deep valleys where an army corps could stay hidden for months. To fight such a foe with soldiers walking slowly and steadily over great distances only meant the retirement of the enemy in good formation when it suited him, and his reappearance rapidly in new positions as hard to take as the last one proved. Consequently it was obviously necessary to increase our mounted strength of cavalry and yeomanry by forming brigades of soldiers armed as foot-sloggers but riding on horses. I cannot imagine a more difficult task than that which fell to the devoted officers and N.C.O.'s of these strange new units. In simple language their task was to convert some 500 men from habitual walkers into skilled riders and horse-masters as soon as possible and in the face of an active enemy. Needless to say the complications and difficulties were immense and not without humour. Endeavours were, of course, made to get men who had some knowledge of horses, but as the proof of efficiency lay in the man's own statement, more or less, and the infantry soldier had very wisely formed the opinion that people who rode on horses were having the best time in this war of "Boots, Boots, Boots, moving up and down again," it behoved him personally to provide himself with a mount as soon as possible. It will be understood that the briefest and most casual acquaintance with a horse sufficed to produce a statement of "Been with 'orses all me life, sir." To see the M.I. moving off in the early days was a great sight, and from "walk march" to "trot" there was a great bumping of saddles, swaying and invariably a nasty crash as some warrior complete with rifle and equipment rolled off to land on the hard ground. But it was remarkable how quickly the men picked up their horsemanship—trust the British soldier to learn any new way of soldiering if you give him time.

On February 12 there was a great concentration of mounted troops at a place called Ramadan as a jumping-off place for a dashing attempt to outflank brother Boer and get to Kimberley. Roughly the plan was to leave old Cronje sitting at Magersfontein watching Lord Methuen's force and to slip round him with a wide sweep east. To do this two important rivers had to be crossed, first the Reit and then the Modder. Like all South African rivers, crossing had to be done at a drift—bridges were non-existent—and the crossing must be done quickly before the Boers knew our intentions. The first point to be secured was Dekiel's Drift on the Reit, to be followed by Klip Drift over the Modder. Once safely over the second crossing a strong and determined mounted force could gallop for Kimberley.

The period February 12 to 15, only four days, is to my mind a bit of brilliant history for the British Army. At certain moments in the Great War, on the Western Front, strange rumours grew that a great "death ride" was to be staged—a break through the enemy trench system and the release of a mass of cavalry to gallop clean away into the blue—it never happened. But it did come off in the Boer War. At Dekiel's Drift Lord Roberts reviewed some 8,000 mounted troops, cavalry, mounted infantry, yeomanry, horsemen from all parts of the Empire massed together for a grand dash to relieve Kimberley—the Diamond City. A great spectacle and a great adventure. French of the cavalry was in command—in later days Lord French of the British Expeditionary Force. My personal impressions are restricted to a memory of great heat, fatigue, thirst and dust. That and nothing more for three days. Then the fourth day and a few incidents to relieve the monotony. Pounding along with my M.I. through a thick dust storm raised by the innumerable hooves, walk, trot, canter and walk again. Riding through a shallow valley with low kopjes east and west. Flashes of guns on those hills and the scream of an odd shell coming over. Boer guns making a desperate attempt to hold up this rapidly advancing force, so strange to him after his months of experience in fighting against patient slowly plodding foot soldiers. A shell seems to fall plump in the ranks of the M.I., but makes no impression beyond causing the men to swing out a bit. No casualties. Canter again and the pace increases. A rattle of rifle fire in front; no check. Riding on I am pulled up by the sight of a man on the ground. I get off and have a look at him. A sturdy middle-aged Boer, bearded, bronzed, wearing the usual rough civilian clothes with the bandolier of ammunition across his great chest. He is groaning from the pain of a lance wound through the shoulder. A 16th Lancer must have done that. They were the advance guard when the enemy strung a weak command across the valley to stop us. The 16th charged through and over, and the way to Kimberley was open. I put a field dressing on the wounded man, gave him some morphia and water and left him. I presumed a bearer company or field ambulance was somewhere behind and would pick him up. Yes, resistance was over, but a long ride to endure before we reached Kimberley. Horses going down from thirst and exhaustion. I gave my own waler short drinks from my water bottle, only sips to him, poor beast, but he carried on. Short halts and men searching about for a water cart. I saw one with an officer standing guard over it and holding a revolver in his grip. For some reason he was refusing to allow anyone to draw water. Then halt at the edge of a dam, just a shallow pond adjoining a farm house. Riding into the dam and letting my horse drink, lowering my water bottle and hearing the welcome sound of water clucking, emptying the bottle and dropping it in for another supply. Turning out of the dam to find troops settling down to bivouac. Finding my own mess and wearily dismounting. Handing over my horse to the groom. Sitting down to eat some "bully-beef" and

biscuit, drink, I think, a spot of whisky and water. Somebody said: "So this is Kimberley, and we have relieved a beleaguered city." The O.C. said: "We can have a look see in the morning." I had a last look at my horse—he looked very tucked up—and I crawled into my valise.

Next morning I rode into Kimberley. In those days it was a typical colonial town. Wide streets with buildings of all sorts and sizes; imposing stone erections fronted by bungalows with corrugated iron roofing. The most common type was a two-storied house with an upper verandah and a deep stoep on the ground floor. I made my way to the Kimberley Club after putting my horse up at a stables. Walking along I looked for signs of war and bombardment, but I could see no smashed buildings or shell holes in the streets. The town seemed very British: the people I passed looked British; Union Jacks were flying everywhere. The names over all the shops were British. Kimberley was obviously an outpost of Empire, newly made, inhabited and worked by Britishers. Not like Capetown that had been Dutch for 200 years before the Britishers came, and still retained its Dutch appearance and language. A nice old lady stopped me in the street and said, "Poor boy, you look very dusty and tired." I felt a hero. I walked up the steps of the Kimberley Club and was at once taken in charge by a member. This kind man first led me to the bar, where he called for champagne. On the counter were wineglasses containing cigarettes. I was offered one and found it was made of Boer tobacco, loosely rolled and twisted at each end. If you smoked it at an angle it held together, if you allowed it to sag all the tobacco fell out. My host apologized for offering me such things, but "Kimberley was right out of cigarettes." Here I was for the first time meeting the horrors of a siege.

The lunch room was very crowded, and I was pointed out many of the famous figures in the great De Beers mining group. On the menu was "mule steak." I found it remarkably good. My best of hosts asked me what more he could do to help me in any way. I said, "I want a bath and a clean shirt." He took me along to his house and arranged for a hot bath. While I was bathing, his native servant went down town and brought me a very handsome shirt. My kind friend was greatly taken with the condition of the shirt I discarded. It was certainly very stained and dirty. When I thanked my host for all his kindness he made a strange request. He asked me to leave him my very dirty shirt as a gift. He intended, he said, to keep it in its present condition and show his friends what the British officers had to go through to relieve Kimberley. There is no doubt we were very uncomfortable, unwashed and dusty and dirty, as all our personal kit had been left behind in a baggage convoy following after us, or to be picked up again at some arranged rendezvous. I never knew what actually was the idea; but whatever it was it was sadly interfered with by the Boers, who captured the convoy and burnt the wagons

and contents. Consequently I was without any kit, saving a great-coat strapped on my saddle, some odds and ends in saddle holsters, and a haversack.

On return to camp I found activity, as we were ordered to take part in a movement north of Kimberley with a view to the capture of a big gun the Boers had been using to bombard the town. This turned out to be a confused little action, carried out by tired troops on very tired horses. The place we were making for was Dronfield. We skirted the town and found ourselves riding down a road traversing extensive vineyards. Presently we saw three horsemen coming towards us. The leader was a big man riding loosely and dressed in a light coat, wide white trousers, silk shirt with open neck and a wide-brimmed soft hat. Our O.C. stopped this little party and asked the big man "were we on the right road for Dronfield?" He turned about and said something to one of his companions. Saying "This gentleman will ride with you and put you on the right road," he touched his hat with his riding whip and cantered away. As we rode on our gentleman guide said "Know who that was?" We disclaimed any knowledge. "That was Cecil Rhodes, and he told me to ask your permission to allow the men to turn aside into one of his vineyards for half an hour, and let them have their fill of grapes." That was a kindly thought from the great Cecil Rhodes, and though one reads that he disliked soldiers and refused to include the "profession of arms" as one of the outlooks in life for a Rhodes Scholar, he acted towards us with consideration and thoughtfulness.

It seems strange to ramble about among vines and eat grapes on the way to a battle! And what a strange battle! Some time in the afternoon we went into action so far as to capture a small kopje occupied by the enemy. We had no casualties but I found two troopers of the Scots Greys in a bad way. They came riding along on very weary horses. One man was holding the other on with an arm round him and gripping in his other hand a blood-stained lance. The two horses were so beat they wanted no guiding. As they came up to me I saw one man, the one being helped, was badly wounded. His right thigh was all swollen, distorted and blood-stained. The man was in dreadful pain and groaned and shrieked alternately. His companion was unwounded and very excited. He kept shouting out "Look at me lance I got one of they Boers (B——s), but they got puir Jock here." Between us we got poor Jock off his horse and on the ground. To my surprise he suddenly became silent and died in a few minutes—shock, of course. A smashed femur and bumped along on a horse finished him. The other man was suffering from the exhilaration produced by the excitement of battle, I suppose prosaically explained by the activity and over-production of the adrenal glands.

I looked about for a Bearer Company but could find no medical unit of any sort. I heard afterwards no medical units could keep up with the troops, and medical officers had to make any arrangements they could for

the wounded. One M.O. of a cavalry regiment was left with wounded in a sort of camp on the veldt and existed by shooting ostriches and small game until found again. I saw one small cart going back towards Kimberley; I rode over to see if I could commandeer it for ambulance work. The cart contained a body wrapped in a blanket and beside the cart rode an officer in some irregular corps. He was brandishing a pistol and informing anyone near that his dead brother lay in the cart and he would shoot any man who tried to interfere with him. As the fight seemed over we rode back to Kimberley. I believe the Boer gun got away.

Another strange encounter was riding part of the way with another officer in some local defence corps; he was beautifully dressed in spick and span khaki drill. He said " We often have these little scraps with the burghers, gives us some excitement now and again; I always finish up the day with a hot bath and then a pint of champagne with my dinner." With that he cantered away to his hot bath. That was the way to soldier, no dirty shirts or lost kit! There was to be no rest for the weary soldier. Immediately on return to camp orders were issued for a move. We heard the good news that General Cronje of Magersfontein had at last, to use a soldier's expression of late years, "got the wind up" and was making a desperate effort to break a way through this unexpected army under Lord Roberts pouring up from the south and threatening to cut him off from his friends in the Free State. It was said Cronje refused to believe his own scouts when they told him British mounted troops were cutting in behind him on Kimberley. He smoked his pipe and grunted, "No, English soldiers can only march along a railway, if they go out into the veldt they get lost." So Cronje sat tight until he was plainly told "The English are *in* Kimberley." Then he hurriedly packed up and started off for Bloemfontein, the capital of the Orange Free State. So General French started off hot foot to get in front of Cronje and stop his dash on Bloemfontein, the while the main army came up and finished off the good work.

As far as I could see we of the M.I. seemed the last troops to move away. And then, being very young and foolish, I did a silly thing. Just as we were hearing the orders " Walk March " a soldier tumbled off his horse and had some sort of violent fit. There were no ambulance wagons or vehicles of any sort to put this man in and take him with us. What was to be done? I volunteered to stay with him and see him into hospital in Kimberley some way or another. I was quite sure I would be able to catch them up as soon as I had disposed of this sick man. And so I stayed. Eventually I found somebody in a Cape cart who helped me to get the man into Kimberley. I made for the Headquarters of the Kimberley Garrison where I found one of our own officers as S.M.O. He relieved me of the sick man and I started away again to overtake my M.I. I soon found myself plodding steadily along a wide track of dusty veldt showing the spoor of many horses. I rode for some hours. Quite suddenly my tired horse quietly collapsed. Obviously he was completely done. Having

off-saddled and led him to the shade of a tree, I just sat down to await events. I seemed to be alone in Africa. Kimberley was still visible in the distance. All around me the wide veldt rolled on to what the marching soldier called "Twenty blinking horizons." I thought it strange the country should be so deserted, but that was explained to me, when, a good many hours having passed, I limped back to Kimberley.

Roving Boer bands were said to be scattered about the veldt making for Bloemfontein, and it was thought strange some band had not picked me up as a prisoner of war. I was ordered to join a small force of Cape Mounted Rifles, the famous C.M.R., or semi-military Police Force of the Cape Colony, and proceed in this Company to Paardeberg, where Cronje had been held up and was holding out in a laager in a bend of the river. So I left Kimberley for the second and, I hoped, the last time. I gathered the siege was not very strongly pressed by the Boers. Their method seemed to be a blockade more than a siege, combined with a bombardment of the town from one or two heavy guns. During the four months ten civilians were killed by artillery fire. The shortage of milk, meat and vegetables was becoming acute when relief came. In comparison with the smashing up of a city like Ypres in the Great War, Kimberley had very gentlemanly treatment, though for the inhabitants, shut up in a small area and shelled whenever the enemy pleased, it must have been an uncomfortable four months. Many people said the Boers only invested Kimberley because they wanted to capture Cecil Rhodes, the man they disliked above all Englishmen—especially since the Jameson Raid, when the 600 Britishers broke into the Transvaal to ride to the rescue of the oppressed people of Johannesberg, denied the vote by President Kruger. Of course the raid failed, was considered a swashbucklering effort, and ended in the surrender, capture, and trial of the leaders. The Boers thought Rhodes was the man behind the movement, and as soon as war came in 1899 they swore to capture Cecil Rhodes. He, quite undaunted, refused to leave Kimberley, which he could easily have done, and remained in the town during the Siege. Our little force marched for Paardeberg with great care. It was the first time I had seen colonial troops in action, and was struck by the very careful way they threw out scouts on the flanks and searched every kopje or farmhouse before we passed, lest brother Boer lay a trap for us. On arrival at Paardeberg I was posted to a field hospital on temporary duty and caused the staff some amusement by the arrival of such a dusty, dirty, unshaven kitless R.A.M.C. subaltern.

(*To be continued.*)

SAND-TABLE CONSTRUCTION.[1]

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(*With Diagrams.*)

Sand models used as aids to instruction in elementary tactics, hill warfare, systems of supply and evacuation and so on, often fall far short of the hopes and expectations of the instructor.

More often than not this is due to gross inaccuracies of proportion, form and colour in the model which render it unnatural and crudely artificial. Much useful work can, of course, be done on models which do not pretend to reproduce any known piece of country, but, where reproduction is intended, it must be accurate.

In this short article it is proposed to describe a method of achieving this accuracy in the hope that it may be of use to those who have not so far succeeded in solving this problem for themselves.

The Table.—The table built under our direction at the R.A.M.C. School of Instruction, 47th Division, T.A., Duke of York's Headquarters, Chelsea, consists of an inch timbered box measuring 12 feet by 5 feet by 9 inches, resting on a trestled under-structure at a height of 3 feet from the floor. The internal surfaces of the sides of the box are marked off longitudinally by parallel lines one inch apart, and this ruling affords a correct and ready method for measuring the heights of contours.

Sand.—For a table of the above size one cubic yard of the best river sand is sufficient. It is advisable, before placing the sand on the table, to have it carefully sieved in order to remove stones and gravel, which are likely to interfere with the construction of the model.

The sand is evenly spread on the table and thoroughly moistened.

Preparation for Construction of a Model.—In order to make an accurate model of any area, it is essential to build the model actually upon an enlarged map of that area.

Scale.—For Royal Army Medical Corps purposes, which involve the working out of intra-regimental evacuation, siting of regimental aid-posts and advanced dressing-stations and so on, we have found by experience

[1] Reprinted, by permission, from *The Army Quarterly*, Vol. xxix, No. 1, October, 1934.

that a scale of approximately 30 inches to the mile is most useful. Larger scales are difficult to make with any degree of accuracy, while smaller scales fail by leaving too much to the imagination.

Enlargement of the Map.—Two copies of the enlargement are required. The best enlargements are made from a 1/20,000 O.S. map.

The following are the methods of enlargement:—

(*a*) By means of a pantograph.

This is a simple instrument used by architects and surveyors, but tedious to use, requiring a considerable amount of time.

(*b*) By means of a magic lantern.

The area of the map to be enlarged is cut into inch strips which are rendered translucent by heating in oil. Black paper is pasted on a plain glass lantern slide in such a way that only one square inch in the centre of the slide allows light to pass through. Spherical aberration is reduced to a minimum in this way.

The translucent strips of the map are attached by adhesive tape to the back of the lantern slide, and, inch by inch, the map is projected on to sheets of newspaper, or white paper with a texture similar to that of newspaper.

The sheets are placed at a distance which gives the required enlargement, and the contours, roads, rivers, houses, and so on, are traced on the paper by means of differently coloured chalks.

(*c*) By means of the epidiascope.

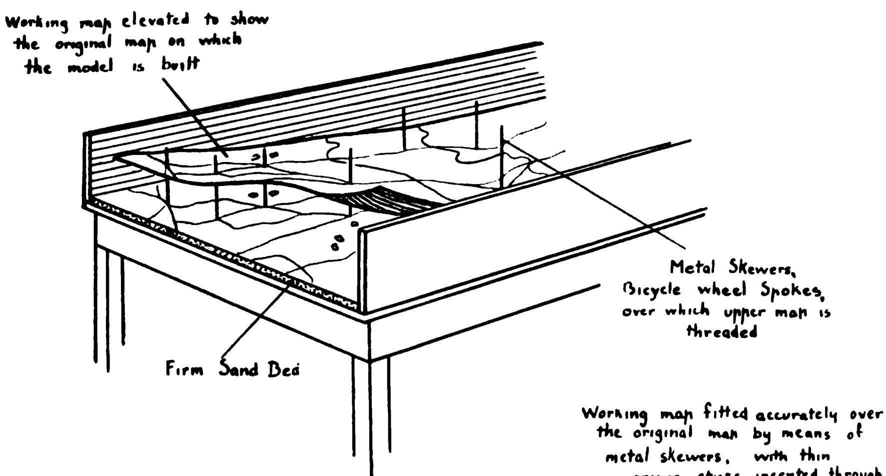
This apparatus affords the easiest and quickest method of enlargement. The map is projected on to paper pinned to a wall. The map is marked out in two-inch squares, and the paper on to which it is projected into twenty-inch squares, and the epidiascope is so focused that the two-inch square is projected exactly over the twenty-inch square. Distortion is avoided by moving the map only, the epidiascope and the position of the paper remaining fixed.

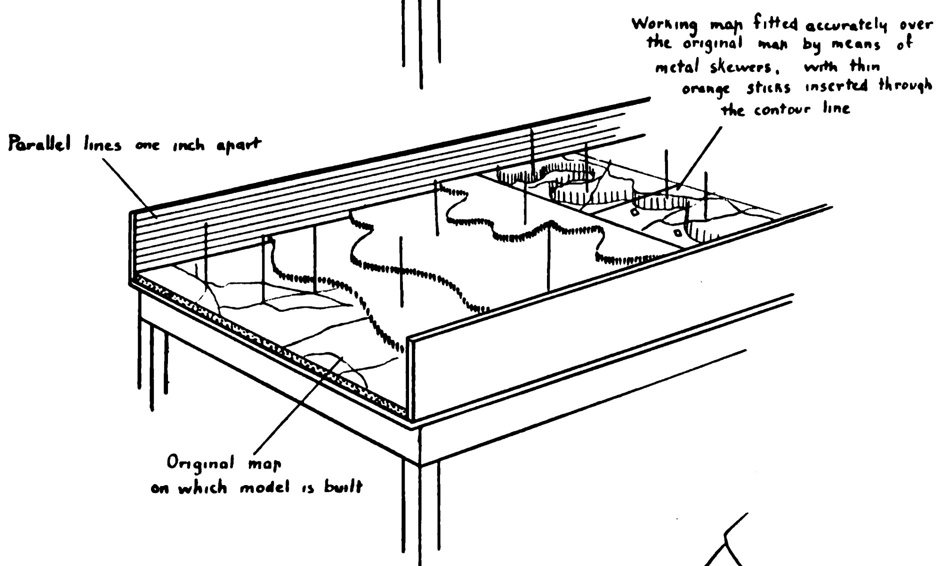
The Construction of the Model.—The two copies of the enlarged map, the one fitting exactly over the other, are pinned face upwards upon a firm bed of sand one inch thick, and, to mark outstanding features on the map, e.g., cross-roads, trig points and so on, thin metal skewers (bicycle wheel spokes) are inserted through the maps and sand layer into the floor of the box. The upper map is then lifted off, but can be replaced accurately over the site of the lower map by means of the skewers.

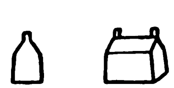
The level of the sand bed corresponds to the lowest ground level.

Thin orange sticks marked off in half inches are inserted at intervals of one inch along the first contour lines. Into the area so enclosed damp sand is tightly packed up to the required level, i.e. of the first contour, and the orange sticks are removed. A thin wire stretched tightly between opposite sides of the box at the level of the second longitudinal marking is moved over the model and the sand is thus cut off at the two-inch level.

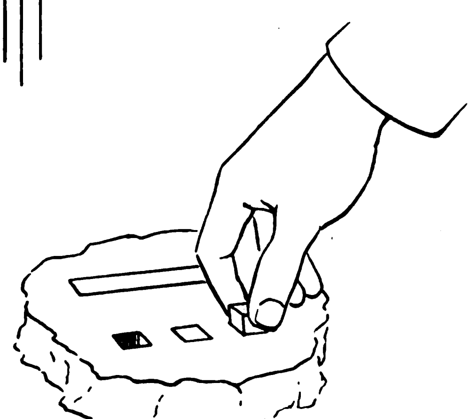
The upper map is replaced over the metal skewers and the second







House. Note that top aspect is slightly smaller than the base



Plaster with wax models embedded

contour lines are marked out by means of the orange sticks. The same procedure is followed and the wire is now drawn over the model at the level of the third longitudinal marking. In this way the model is gradually and accurately terraced out. Where under features are of importance additional contour lines must be drawn in on the map before it is enlarged.

The sharp ridges are then smoothed off and the whole is pounded by means of a handful of damp sand enclosed in a wet duster. The model is then covered with a wet cloth and the sand thoroughly moistened with a fine rose watering-can.

Marking of the Model.—The cloth is removed square by square. The working map is replaced and the positions of the roads, rivers, trees, houses, and so on are indicated by pricking the sand through the map by sharp skewers. These impressions must be faint.

Colouring.—Pasture land is shown by covering the areas with grass-green distemper which is shaken evenly from a pepper box. Distemper has a great advantage over chalk in that it is quickly moistened by the sand. It cakes together, and in so doing binds the sand to form a fairly firm surface. Coloured areas must not be touched as the distemper comes away in large patches on the fingers.

Heather is indicated by red and blue stippling, ploughed land by brown, and cereal crops by yellow distemper.

Haystacks may be made of wax or carved out of yellow chalk. Miniature trees are made from young green sprigs of heather. These are cut according to scale and sharpened for insertion into the damp sand.

Hedges are represented by wool of varying shades of green held in position by small pins.

Marking of Roads.—First-class roads are shown by $\frac{3}{8}$ of an inch tape, painted dull red with oil paint, second-class roads by $\frac{1}{4}$ of an inch tape painted brown, and third-class by $\frac{1}{8}$ of an inch tape painted dull yellow. Foot-paths and bridle-paths are indicated by $\frac{1}{8}$ of an inch tape painted grey-white. Oil paint is used in order to avoid diffusion of colour. All tapes are pinned to the sand over the impressions already made by the sharp skewers. The map is consulted at each step in case impressions have been obliterated by distemper.

Modelling of Houses.—Buildings are made in mass from hard candle wax. Scale specimens of houses, rows of cottages, huts, and so on, are modelled in wax, care being taken that the bases are made slightly wider than the tops. These are inserted into prepared dental plaster of Paris, which, after solidification, is dried in a hot oven and hardened. Hot water is poured over the mould and the wax is melted and washed out. The mould is pared and the sharp edges are removed. It is then well soaped over with a shaving brush and molten wax is poured in. Upon solidification the cast is removed and painted appropriately with oil paint. Bridges are modelled in a similar fashion.

Rivers and Lakes.—Large rivers are made by cutting them out from

the enlarged map, painting the strips blue or grey with cellulose paint and pinning them into position on the sand. Ponds and lakes are similarly made.

Railway Tracks and Telegraph Poles.—Railway tracks are formed from strips of three-ply wood three-eighth of an inch in width over which strands of brass or copper wire are stretched to represent the metals. It is necessary to build in the railway tracks when building the contours.

Telegraph poles are represented by black pins inserted according to the scale.

As each square is completed the model is checked and touched up, and all pin-heads are painted the appropriate colour.

Lighting.—It is most important that the lighting should be diffuse in order to obtain the best results. It should be from above and tinged with blue. A strong direct white or yellow light gives an artificial appearance to the mould.

Editorials.

ON THE STATE OF THE PUBLIC HEALTH.

The Annual Report of the Chief Medical Officer to the Minister of Health for the year 1933 is full of interest to all medical officers of the Army, and especially to those who have specialized in hygiene.

The Report commences with an estimation of the population concerned, and it is stated that the mid-year population of England and Wales in 1933 was 40,350,000, consisting of 19,357,000 males, and 20,993,000 females. The gradual rise of the age constitution of the population continues and at about the same rate. The natural increase of the population is only 83,948, a figure less than one half that of 1930 and about one-seventh of that ruling fifty years ago.

The average annual birth-rate per 1,000 living was 14·4, the lowest rate on record; the average annual death-rate was 12·3, the same as in 1931, but 0·3 higher than in 1932. The average annual infant mortality, i.e. deaths of children under 1 year of age per 1,000 births, was 64, compared with 100 in the period 1911-1920, and 149 in the period 1871-1880.

The five principal certified causes of death at all ages and the proportion per 1,000 deaths were: Diseases of the heart and circulation, 269; cancer—malignant disease, 124; bronchitis, pneumonia and other respiratory diseases, 113; diseases of the nervous system, 79; all forms of tuberculosis, 67.

If the causes of death are set out in order of magnitude for the age-period, 15 to 65, man's working life, the order is different, and all forms of tuberculosis take the third place, emphasizing the fact that tuberculosis takes a heavy toll during man's working years.

The Chief Medical Officer does not expect there can be any spectacular improvement in an infantile mortality rate of 64 per 1,000. He points out that there has been a marked change in the quarterly incidence of infant mortality from 1870 to the present time. Up to about 1911-15 the September quarter produced the highest infantile mortality, but following on the fall in mortality from epidemic diarrhœa the September quarter now yields the lowest quarterly rate and the March quarter the highest.

Deaths by violence now include those resulting from road accidents. In 1933 there were 175,738 accidents and an official analysis with reference to allocation of blame to various classes of traffic gave the following results: Private cars, 58,256; pedal cycles, 41,002; motor cycles, 35,864; motor vans, lorries, etc., 24,679; public passenger mechanical vehicles, 12,154;

horses and horse-drawn vehicles, 2,883. When the numbers of journeys made by the ten to twelve million vehicles on the roads are considered the figures do not seem very surprising, but that they can be reduced by greater skill is evidenced by the comparatively small number of accidents, 12,154, resulting from omnibuses, taxi-cabs and other public vehicles which are on the road from morning until night. It is thought that an even greater reduction in the number of accidents would be effected if pedestrians took more care for their own safety. To them were attributed 40 per cent of the road deaths in Great Britain in 1933.

Discussing the trend of mortality in early childhood and in adolescence the Chief Medical Officer points out that, although there has been little direct action by the State on behalf of the pre-school child, the greatest improvement in mortality over the past three-quarters of a century has been recorded at the ages 1 to 5 years. There has been an unbroken decline in the death-rate since 1861-70 and the relative improvement has been double that found in the first year of life. The death-rates at 1 to 5 show wide variations between the geographical and administrative areas. The mortality in County Boroughs is far greater than in Rural Districts ; there is evidently still wide scope for reduction in the mortality of the pre-school child in county areas.

In adolescence, ages 15 to 20 years, the death-rate in 1921-30 was only 30 per cent of the rate registered in 1861-70. The chief cause of mortality is respiratory tuberculosis, which was responsible for nearly one-third of the deaths of males and one-half of the deaths of females.

Compared with pre-War years there has been a substantial decline amongst adolescent males but very little decline amongst adolescent females.

In the introduction to the Section on General Epidemiology the Chief Medical Officer states that the large group of infectious diseases may be divided into two types: (1) Those like cholera, typhus, typhoid, plague, dysentery, malaria and hydrophobia, which for their propagation require a particular environment ; and (2) those which are spread by personal contact, probably by droplet infection, as for example diphtheria, scarlet fever, cerebrospinal fever, and so on.

A much greater advance has been made in the control of the environmental than of the personal diseases ; knowledge of the method of transmission has enabled the epidemiologist to control the environment and so to control the disease. The great improvement in the death-rate from typhoid fever and paratyphoid fever is almost certainly due to improved water supplies.

The prevention of the personal diseases is a much more complicated problem. A very great difficulty is diagnosis, which is often impracticable until the disease is well established, by which time the period of greatest infectivity is over. It is impossible to prevent personal infection by

immobilizing the population, but it seems possible to render the spread comparatively innocuous by diluting the infection and by increasing the resistance of the recipient. Infection may be diluted by the isolation of avowed cases, continuous and intimate contact may be lessened by the reduction of overcrowding, and the individual may be fortified by adequate nourishment and possibly by active immunization.

In 1933, there were only 631 cases of variola minor notified compared with 2,039 in 1932, and in the December quarter no cases were notified outside London. The experience of other countries in which variola minor has been prevalent leads to the belief that recrudescence of the disease is unlikely and that we may shortly expect its complete absence.

Variola major may, however, still occur as is shown by a short outbreak in Blackburn in 1934. The first case who died was a stripper of Egyptian cotton. This patient was directly responsible for twenty-one cases and indirectly for four others. There were three fatal secondary cases, all of whom were unvaccinated. Painstaking inquiries by the Ministry failed to reveal any contact of the first patient with a case of smallpox, and it appears probable that the infection was conveyed by the Egyptian cotton which it was subsequently found came from an infected district. Cotton as a vehicle of infection has repeatedly been suspected and previous cases have been reported at Stockport in 1908 and 1909, and Heywood, Colne and Chadderton in 1910. In the Stockport and Heywood outbreaks the suspected cotton was of Egyptian origin. It would appear that the early processes of cotton manufacture, mixing, blowing, carding, etc., in which large quantities of dust and debris are separated from the cotton fibre, involve the major risk.

Seven cases of post-vaccinal encephalitis occurred in 1933. All were adolescents or of school age and none had been vaccinated previously. Only one case died. It is considered important that business organizations, convalescent homes and other institutions which make recent vaccination a condition of employment or admission should know that "the Minister is of opinion that in the present state of our knowledge and so long as the smallpox prevalent in this country retains its mild character, it is not generally expedient to press for the vaccination of persons of these ages (adolescence and school ages) who have not previously been vaccinated, unless they have been in personal contact with a case of smallpox or directly exposed to smallpox infection." In institutions where vaccination has been the custom the introduction of an unvaccinated newcomer, even should he contract smallpox, would entail little danger to the community.

The importance of measles as a cause of death is again pointed out by the Chief Medical Officer. The number of cases is not actually known, but it is estimated that 50,000 occur in the biennial London outbreaks and the disease is second only to whooping-cough as a cause of death among the infectious diseases. As a protection for non-immunes there has been a demand for human serum for therapeutic purposes; this cannot be met

commercially and the Chief Medical Officer recommends the organization of municipalities for the collection of this material. The laboratory technique to be employed has been described by Dr. McCartney in the L.C.C. Report, 1933, on the measles epidemic.

There were 129,528 cases of scarlet fever notified in 1933, and of these 729 were fatal, giving a mortality of 5·6 per 1,000. This represents an increased incidence of more than 50 per cent over the figure for 1932, and is the highest recorded since 1921. The disease has been of the relatively benign type now observed for many years, and so far there is no indication of a change in type.

Local authorities have been faced with the problem of the isolation of scarlet fever patients in hospital, and in many instances isolation hospitals have been overcrowded to the detriment of the patients and staff. The Chief Medical Officer has repeatedly drawn attention to the evil effects of this overcrowding and pointed out that not only is the indiscriminate removal of all scarlet fever patients unnecessary on medical grounds, but it is often unwise. Some clinicians have held that scarlet fever is not a definite clinical entity. It is known that milk infected by direct or indirect contact with scarlet fever cases when drunk by susceptible people will not produce the same symptoms in all of them, there may be several different clinical pictures. It is also known that though one attack of scarlet fever usually protected a patient against a second attack, a relapse very like a second attack frequently occurred about the third week of illness. In the Ministry's Laboratory Dr. Griffith has shown that there are many strains of the hæmolytic streptococcus which can be differentiated as they occur in different clinical manifestations. One strain of streptococcus does not protect against another, and the so-called "relapse" may be a fresh infection by a streptococcus differing serologically from that of the primary infection. Infection due to these different streptococci cannot be diagnosed clinically, and in a scarlet fever ward containing several beds cross infection is likely to occur. Dr. Griffith's work is considered to afford a strong plea for adequate bed spacing in scarlet fever wards and for the provision of special wards for convalescent scarlet fever patients.

The Committee of Medical Officers on Scarlet Fever reported in 1927 that . . . "On the whole less attention has been devoted to the possibilities of efficient home treatment than the evidence we have examined seems to justify." Sir George Newman considers that is the position to-day, and the time has now come not only for insisting that a large number of clinically typical scarlet fever patients should be nursed at home, but for maintaining that a scarlatiniform rash should no longer be considered in itself a justification for immediate removal to hospital.

In 1933 47,435 cases of diphtheria were notified compared with 43,399 in 1932. The fatal cases numbered 2,646, giving a mortality rate of

5·5 per cent as compared with 5·4 per cent in 1932. The cases were usually mild though occasionally severe cases occurred which did not respond well to antitoxin treatment. Research on *gravis* and *mitis* strains of the *Corynebacterium diphtheriæ* is being carried out and it is thought that an anti-bacterial serum may be therapeutically valuable.

The Memorandum on the "Production of Artificial Immunity against Diphtheria," issued by the Ministry in 1933, is purely advisory and leaves Medical Officers of Health to choose the technique and reagents which they regard as best adapted to their purpose. It is now a common practice to omit the preliminary Schick test in young children as they are usually found to be susceptible, and by so doing the procedure is shortened. The results of immunization are not ascertained for each case, but by sampling.

The Annual Reports of Medical Officers of Health show that immunization is practised in about one-half of the Metropolitan and County Boroughs, and has been employed in smaller sanitary districts in twenty-three counties.

During the year 1,758 cases of enteric fever were notified: these cases included typhoid and paratyphoid fever and compare with 2,544 notified in 1932 and 2,276 in 1931. It is stated that the experience of the year brought out no new features, but confirmed those of previous years. Of the environmental diseases, enteric fever is the most susceptible of control, and by the improvement in water supply the death-rate from this disease has, within the last thirty years, fallen from 174 per million living to six. Sir George Newman points out that the *B. typhosus* is still with us, and when conditions are favourable to its transference to human beings outbreaks may occur such as that at Kidderminster where some 4,000 people became suddenly ill with vomiting and diarrhœa. Some days later nine cases of enteric fever were notified in the town. The distribution of the cases was coincident with that of the water supply, and there is no doubt that the infection was water-borne. A similar occurrence in Blackwell rural district was reported on by Dr. Rees: there were 1,000 cases of diarrhœa and vomiting and six of the patients developed enteric fever within the incubation period of that disease. It has long been known that one of the characteristic features of water-borne outbreaks of enteric fever is the prevalence of diarrhœa two or three weeks before the cases begin to be notified. Sir George Newman says that the fact that *B. typhosus* was almost certainly present in the water supply of Kidderminster at a time when the town was free from notified cases is disquieting, but he recalls the fact that *B. paratyphosus* was present in the sewage of Epping many months after the last case had occurred in the town.

During the winter 1933-34 influenza was not very prevalent, the highest weekly number of deaths in the 118 great towns was 115 compared with the weekly maximum of 1934 in the previous winter. Reference is

made in the report to the discovery of Laidlaw, Andrewes and Wilson Smith that the ferret can be infected by filtered washings from the naso-pharyngeal mucous membranes of human cases of the disease. The filtered material from an infected ferret has conveyed infection to another and in this way a strain of virus has been maintained for experimental work.

Psittacosis occurred in three women who had kept budgerigars as pets. The women suffered from a combination of abdominal and pneumonic symptoms and one of them died. Dr. Bedson of the London Hospital examined blood from two of the women by complement fixation on two occasions during convalescence. He reported that the test indicated the presence of specific antibodies in both serums and expressed the opinion that without doubt both patients had suffered from psittacosis. Sir George Newman states that this "disease should always be borne in mind when one or more patients in a household have an influenzal type of illness with early signs in the lungs and such symptoms as epistaxis or abdominal distension, particularly if blood examinations for the enteric groups of organisms and for *B. abortus* are negative. From such patients the sputum should be examined for the presence of Levinthal-Coles-Lillie bodies and a filtrate inoculated into mice. If there is no sputum the patient's blood may be used for inoculation and also examined for complement fixation and for the precipitin reaction. In all such doubtful cases the association of the patient with birds should be inquired into."

The Ministry is anxious to discover to what extent psittacosis is present, both as a human disease and among birds, in England and Wales, and is willing to assist in the diagnosis if any difficulty is experienced.

During the year 783 cases of dysentery were notified in England and Wales. It is now well recognized that bacillary dysentery due to Flexner and Sonne infections is endemic in this country and the administrative measures required in dealing with the disease were outlined in the Chief Medical Officer's Annual Report for 1930. He states that many cases of illness described as gastro-enteritis, gastric influenza and colitis would undoubtedly be more precisely described as bacillary dysentery if proper laboratory examinations of the stools were made in the acute stage of the disease. The disease is particularly liable to occur in epidemic form in hospitals for sick children, especially in infants' wards, orphanages and homes for mentally defective children, as well as in mental hospitals.

Protozoologists have shown that *Entamœba histolytica* is not uncommon in England and probably some seven per cent of the population are infected. It has been suggested that the rarity of clinical manifestations of infection in comparison with the proportion of persons harbouring the parasite may be due to tolerance established between the parasite and the population in which it has long been living. The parasite exists with difficulty apart from its host and is probably conveyed more often on food

infected by carriers, or by dust and flies, than through contaminated water supplies. An investigation, however, of a recent outbreak in America, where 700 cases in 206 cities were traced to two hotels, showed that there was a connection between water and waste pipes through which contamination of the water supply of both hotels might have occurred and thus caused the infection of the guests. Carriers of amœbæ were found in the kitchen staff of both hotels, but the epidemic was considered too widespread to have been disseminated by food alone.

In 1933, Dr. Pickles published an outbreak in a small community in Yorkshire of a disease which he thought was the same as that described by Dr. E. Sylvest in 1930 and 1934 in Copenhagen as myositis acuta epidemica. From articles in recent journals it would appear that the disease has a notable degree of infectivity and that it is neither new nor rare in this country. The disease begins suddenly with pain in the upper muscles of the abdomen accompanied by headache and pyrexia. The location of the pain and tenderness below the xiphisternum is considered highly characteristic, though other muscles may be affected. The disease lasts from a few hours to a week. The pathology of epidemic myalgia is unknown and there is no special treatment.

Since the peak year of 1924 there has been a steady decline in the number of notifications of encephalitis lethargica; but the number of deaths has not declined proportionately, which is probably due to a proportion of patients not notified during life and also of patients notified in previous years and dying after an interval of chronicity.

In Europe encephalitis lethargica or "epidemic encephalitis" has been characterized by a spring prevalence, but in Japan and America there has been an autumn prevalence which has raised the question of the existence of two types, the "winter" and the "summer" encephalitis. The same virus, or agent, appears to be present in both types, with clinical manifestations depending on its location in the central nervous system.

There were 714 cases of poliomyelitis in 1933 compared with 656 in 1932 and 339 in 1931. The deaths were 135, 103 and 63 respectively. The difficulty of obtaining an adequate amount of human immune serum in this country is stated to have prevented its employment for the prophylaxis of those exposed to infection of poliomyelitis, but an antiserum has now been prepared from the serum of the horse at the serum department of the Lister Institute and is procurable commercially. The Chief Medical Officer reports that a limited stock of human serum is available at the Western Fever Hospital of the London County Council and is issued gratuitously on application.

The notifications of cerebrospinal fever were 1,695 in 1933, 2,136 in 1932, 2,167 in 1931, and 664 in 1930. In 1924 only 397 cases were reported.

During the twelve months from April 1, 1933, to March 31, 1934, 169 cases were examined serologically at the pathological laboratory of the Ministry and classified as Group I or Group II as recommended by the Second International Conference at Paris in 1922. Of the 169 strains, 112 (=66 per cent) belonged to Group I and 57 (=34 per cent) to Group II.

In the epidemic area of the West Riding of Yorkshire Group I was preponderant in previous years and of 89 strains from this area 86 per cent belong to this group, whereas in non-epidemic areas (chiefly London), of 80 strains only 45 per cent belonged to this group. The epidemic of the War years, 1915 to 1919, was caused by meningococci belonging in about equal proportions to Group I and Group II, and it would seem that Group II was then more pathogenic than in the relatively non-epidemic period, 1931-34, in most parts of England and Wales. No satisfactory explanation has been advanced for the high incidence of Group I in the recent epidemic in West Yorkshire, and there has been only a moderate tendency for the disease to spread in epidemic form from this area. The clinical type of Group II is not noticeably milder than that of Group I. It has been suggested that the meningococci of Group II are less capable of penetrating the defensive barrier of the meninges, but once having penetrated they can produce meningeal inflammation with all its consequences.

An analysis of the records of serum treatment is still being made and the results so far are distinctly encouraging. A case-fatality rate of 26·9 per cent has occurred in 811 cases treated under conditions permitting of a valid assessment of the therapeutic effect of the serum.

In our next Editorial we hope to deal with other sections of Sir George Newman's most interesting Report.

PHYSICAL EFFICIENCY AFTER OPERATION FOR HERNIA.

At the British Medical Association Meeting in July, 1934, Mr. Max Page gave an interesting address on physical efficiency after operation for hernia.

This question is of great importance to the Army as hernia is a frequent occurrence, and few men who are not cured by a radical operation are fitted to continue in the Service.

Mr. Page, from a review of his own figures and those of other surgeons, is inclined to the belief that recurrences following radical operation are far more frequent than is generally believed. Of special interest to the Army are his statistics as Consulting Surgeon to the Metropolitan Police, a body some 20,000 strong, of picked physical efficiency and young to middle-aged. In the five-year period from 1929-1934, 241 police officers were operated on for inguinal hernia. In 212 the operation was primary, in 25 the operation was for recurrence of the hernia, which suggests an approximate recurrence rate of 11·5 per cent. An investigation of the previous five-year period showed the incidence of recurrence to be even higher than this figure.

Mr. Page quoted the statistics of Block which give the collective results of 20,199 inguinal hernia operations. Only 6,029 of these were followed up for two years or more, and in this group 296 recurrences were reported. This gives 4·9 per cent of recurrences in this group, but the total figure for all the untraced is likely to be higher; 34·8 per cent of these recurrencсs took place after two years.

The figures for the Army are of interest, especially when compared with the figures for the Metropolitan Police Force. These are comparable from the fact that they are a picked class of young adults. As regards physical strain subsequent to operation it is considered that the soldier is exposed to greater stress than the policeman.

In the Army the following operations for the radical cure of hernia were carried out:—

In 1928,	450	cases,	including	21	recurrent	cases
1929,	496	,,	,,	24	,,	,,
1930,	456	,,	,,	31	,,	,,
1931,	434	,,	,,	31	,,	,,
1932,	434	,,	,,	24	,,	,,

This makes a grand total of 2,270 operations for the five-year period amongst which 131 were operations for recurrence of the hernia.

Experience in the Army indicates that most recurrences appear within a year after operation, and by far the largest majority within a few months.

Consequently this recurrence rate, which is remarkably constant in the five years reviewed, may be taken as a fair average of what is to be expected, and gives a percentage of recurrences of approximately 5·7 per cent. While this would appear to be a considerable improvement on the figures for the Metropolitan Police, it must be accepted with some caution.

Although every recurrence that takes place while the soldier is serving comes to light, further cases of recurrence must take place at later dates, and with the present short term period of Colour service of the soldier it cannot be claimed that the follow-up is over a sufficiently prolonged period.

In this connexion the figures quoted by Mr. Max Page from Block's statistics show that no less than 34·8 per cent of the recurrences amongst the 642 cases of recurrences traced took place after the second year.

Regarding the influence the period of recumbency following operation has on the incidence of recurrences, Block did not find that the period of recumbency following operation had any influence on the incidence of recurrence; also the type of suture material used did not appear to influence the result.

Figures from America show a much more optimistic attitude, and one series of 1,618 cases is given in which it is claimed that the general recurrence rate is 2·9 per cent and for indirect inguinal hernia only 1·3 per cent. Max Page points out that these figures were obtained from a quite inadequate follow up.

Clinical and other Notes.

A CASE OF MYELOBLASTIC LEUKÆMIA,

By Major F. S. GILLESPIE,

and

Major J. H. C. WALKER,

Royal Army Medical Corps.

The patient, a master gunner of the Royal Artillery, aged 36, service 20½ years, was admitted to the Military Hospital, Imtarfa, Malta, on January 17. 1934, suffering from acute tonsillitis.

Previous History.—Tonsillitis in 1929 and 1930.

Condition on Admission.—The patient was a man of good physique. Both tonsils were acutely inflamed and covered with numerous follicles. Throat swab was negative to Klebs-Löffler bacillus.

The disease ran a very severe course and was complicated by marked epistaxis on January 20; a right-sided quinsy which developed rapidly on January 23 was opened on January 24 and a large quantity of pus evacuated. From then on there was a very marked improvement in the patient's condition, but although he felt quite fit and was anxious to be discharged from hospital, his temperature never settled, rising each evening to between 99° and 99·4° F.

The swelling of the right tonsil never subsided completely and pressure with a spatula would evacuate pus from the crypts.

As this condition was not improving and the left tonsil was also enlarged it was decided to transfer the patient to the care of the Ear, Nose and Throat Specialist, Royal Naval Hospital, Malta, on February 14, with a view to having tonsillectomy performed.

Both tonsils were dissected out on February 15. The right tonsil was very congested and there was fairly severe hæmorrhage from its bed; no pus was seen and both poles were tied.

On February 16, the day following the operation, the patient's condition was comfortable, but on February 17 the temperature rose to 101° F. and pulse to between 160 and 170. The total leucocyte count was 20,600.

On February 18 the patient's condition still gave cause for anxiety. The leucocyte count was 23,600 in the morning and 22,000 in the evening.

On February 21 the leucocyte count rose to 26,800 and the patient had developed a troublesome cough.

On February 22 there were two severe attacks of hæmorrhage from the right tonsil bed which were controlled with difficulty by plugs of wool

soaked in adrenalin. There was marked sepsis in the tonsil bed. The leucocyte count was 28,500.

On February 23 the patient's condition had improved. Nothing abnormal was noted in the chest or abdomen. The spleen was not markedly enlarged. X-ray examination of the chest revealed nothing abnormal. Leucocyte count was 60,000. Red blood cells 2,040,000. Hæmoglobin 50 per cent. Colour index 1·2.

Differential Count.—Polymorphs, 15 per cent; monocytes, 1·75 per cent; lymphocytes, 26·25 per cent; eosinophiles, 0·25 per cent; normoblasts, 0·25 per cent; myeloblasts, 56·75 per cent.

The patient's general condition improved except for a cough, although the leucocyte count remained high, being 80,000 on February 24 and 75,000 on February 25.

The patient was transferred to the Military Hospital on February 26; the tonsil beds were clearing and the leucocyte count was 75,000. Benzol 5 minims in gelatine capsules was given three times daily.

From now on until March 6, when the patient died, the temperature was irregular, varying between 101° and 103° F., with pulse varying from 106 to 114. Respiration 28, and increasing towards the end. During this period he suffered greatly from a most distressing cough which nothing really relieved; there was marked dyspnœa and profuse expectoration.

Examination of the heart revealed a double mitral murmur and a diastolic murmur over the aortic and pulmonary areas, these becoming increasingly difficult to hear towards the end and sounds were very faint. The spleen was palpable on February 26, and the liver was enlarged. Patient became gradually weaker with increasing dyspnœa and died on March 6.

Permission was given for a partial post-mortem examination which revealed the following:—

Lungs: Dark. Congestion in lower lobes, both sides.

Heart: Very large, blood-stained pericardial effusion, marked acute fibrinous pericarditis on heart wall and pericardium. Right side of heart engorged and filled with white clot. Left ventricle markedly hypertrophied. Weight of heart 18 ounces.

Liver: Enlarged to umbilicus. Weight 100 ounces. Pale and fatty in appearance. Portal system engorged with white clot. No marked enlargement of lymph glands.

Spleen: Weight 11 ounces, granular and paler than normal.

Kidneys: Weight 7 ounces each. Congested.

Suprarenals: 1 ounce each. Right, hard and fibrous.

Intestines: Normal in appearance; no enlarged Peyer's patches. Lymph glands not markedly enlarged. Microscopic examination of lymph glands and of liver, spleen and kidneys showed large numbers of myeloblasts.

The blood-counts are enumerated below:—

TABLE SHOWING THE RESULTS OF BLOOD COUNTS.

	H.B. percentage	Red blood cells	White blood cells	Colour index	Myeloblasts	Myelocytes	Premyelocytes	Polymorphs	Large lymphocytes	Small lymphocytes	Monocytes	Eosinophiles	Türk's cells	Normoblasts
17.2.34	—	—	20,600	—										
18.2.34 a.m.	—	—	23,600	—										
18.2.34 p.m.	—	—	22,000	—										
21.2.34	—	—	26,800	—										
22.2.34	—	—	28,500	—										
23.2.34	50	2,040,000	60,000	1·2	56·76	—	—	15·0	26·25	25	1·75	0·25	—	0·25
24.2.34	—	—	80,000	—	56·25	—	—	13·75	26·0	5	3·5	—	—	0·25
25.2.34	—	—	75,000	—	37·5	—	—	19·75	33·0	5	9·25	—	—	2·0
26.2.34	—	—	75,000	—	36·5	—	—	18·75	32·0	75	12·0	—	—	1·25
28.2.34	45	2,410,000	70,600	0·94	50·0	—	9·0	18·5	1·5	21	—	—	—	—
3.3.34	30	2,020,000	50,400	0·8	55·0	1·5	0·5	18·0	1·0	21	—	2·5	0·5	—
5.3.34	35	2,000,000	72,000	—	55·0	—	—	—	—	—	—	—	—	—

Red cells showed marked anisocytosis, poikilocytosis and diffuse polychromasia throughout.

We are indebted to Major A. Jackson, R.A.M.C., Officer Commanding Military Hospital, Imtarfa, for permission to forward these notes for publication.

NOTES ON TWO INTERESTING CASES OF INFECTIOUS DISEASE.

BY MAJOR P. J. S. O'GRADY,

Royal Army Medical Corps.

(*Continued from p.* 402, *vol. lxiii.*)

CASE II.—SCARLET FEVER.

Gunner I. H., aged 18, service six months. Previous history: Had a slight fever of about four days' duration, at the end of which period he developed a rash and was sent for admission to Tidworth Isolation Hospital on February 24, with a diagnosis of measles. He had not had measles or scarlet fever so far as he could remember.

Condition on admission: He had a rash typical of measles and bronchial symptoms; the diagnosis of measles was confirmed by the medical officer who saw him. I saw him on February 24, he then had slight pyrexia; temperature 99·4° F.; a rash with distribution typical of measles, which appeared on the fourth day; conjunctivitis in both eyes and photophobia. Laryngeal and bronchial symptoms with congested fauces and slight diarrhœa. I saw no reason to disagree with a diagnosis of "measles."

Progress of the case: On February 26 his temperature was 103° F., pulse 130, respirations 26; he had a very restless night, was at times

delirious and perspired freely. Fauces were congested and conjunctivitis well marked—râles and rhonchi all over the chest.

The urine was normal, a throat swab was negative for Klebs-Löffler bacillus; only staphylococci found. Blood-count gave white blood cells 12,500; polymorphonuclears 72 per cent; mononuclears 28 per cent. In the evening he became very toxic, and his temperature reached 104·4° F.

On February 27 a distinctly fresh rash appeared, scarlatiniform in appearance and distribution. Profound toxæmia continued. He had pains in the limbs, a sore throat and strawberry tongue. The urine showed traces of albumin. He was very restless all day, becoming at times delirious and violent, and had to be put under restraint.

On February 28 patient was still profoundly toxic and incoherent in speech. Continual restraint was necessary. Profuse discharge from nasal orifices. Mouth very septic. He was given twenty cubic centimetres streptococcus (scarlatina) antitoxin.

Blood-count gave white blood cells 14,375; polymorphonuclears 72 per cent; mononuclears 28 per cent.

During the night his temperature rose to 105° F.

On March 1 he was weak and exhausted and his condition very critical. There were râles and rhonchi very marked all over chest. The heart was somewhat dilated—pulmonary second sound markedly accentuated—well-marked aortic presystolic murmur with suspicion also of aortic systolic murmur.

Blood culture was negative. Urine contained albumin, 0·02 per cent. No casts. Toxæmia continued during the day and dilatation of heart was marked.

On March 2 there was slight improvement in the morning—twenty cubic centimetres antistreptococcus serum given. Later he became violent and delirious. Temperature rose to 103° F. about midday and fell to 101° F. at 6 p.m.

On March 3 twenty cubic centimetres scarlatinal serum were given, also stimulants and strychnine $\frac{1}{16}$ grain. Heart condition continued to be serious. Grave fear of a streptococcal endocarditis. He had alternating hysterical outbursts and periods of apathy. There were profuse discharges from mouth and nose. Quinine hydrochloride with tinct. ferri. perchlor. given.

On March 4 condition was still grave—hysterical—potassium bromide twenty grains every four hours. Scarlatinal serum, twenty cubic centimetres given. Blood-culture was negative.

On March 5 heart condition still grave. Had one or two attacks of dyspnœa during night; oxygen given.

On March 6 he had a bad day. Heart condition unchanged. Very drowsy. Slight discharge from the right ear.

On March 7 he developed a profuse discharge from both ears and was quite deaf. Throat still very congested and exudate present. Anti-diphtheric serum 4,000 units given.

On March 8 there was a consultation with a medical specialist (from Royal Victoria Hospital, Netley). He did not think that a meningitis was present: prescribed adrenalin ♏v. Agreed that endocarditis was present; also some degree of anaphylactic shock.

On March 9 general condition slightly better but heart condition still unchanged. Profuse discharge from ears continues.

Blood-count: white blood cells 18,750; polymorphonuclears 78 per cent.

On March 10 toxic condition increased. Discharge from ears somewhat less (mastoids not tender). Lumbar puncture performed, ten cubic centimetres drawn off—no pressure, fluid normal. Heart condition unchanged. Considerable lessening in aural discharge. Oral and nasal discharges still copious.

On March 11 the right side of his face became swollen and tender; X-ray showed pus in right antrum and right frontal sinus. Condition very critical.

On March 12 sinus was opened and drained (by specialist from Royal Victoria Hospital, Netley). Much pus mixed with blood evacuated. General condition unchanged. Developed a marked tenderness of both wrists and ankle-joints. Temperature rose to 105° F. Methyl salicylate applications locally.

On March 13 the sinus was draining well. General condition slightly better. Gave "S.U.P." 36, 0·01 gramme. Cardiac condition unchanged. Had a better day generally. Somewhat more rational.

On March 14 improvement maintained. Some distension of abdomen. Joints tender. "S.U.P." repeated—salol t.d.s.

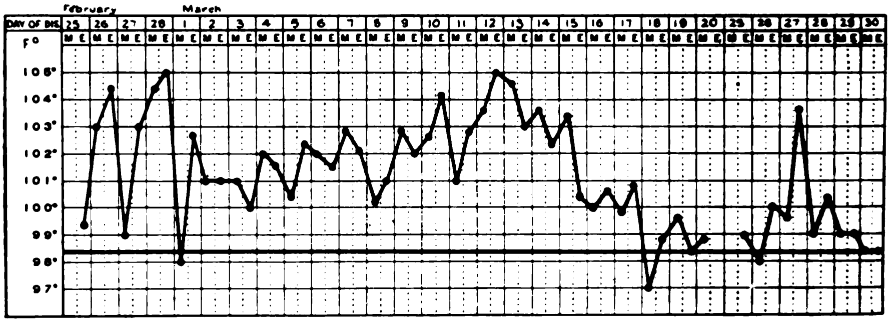
On March 15 a good night and improvement maintained. Discharges from nasal orifices and ears considerably less. Sinus draining well. Joints still tender. Abdomen normal. Heart condition unchanged. Blood-culture negative; white blood cells 12,500; polymorphonuclears 77 per cent. Patient showed an extraordinary improvement in general condition. Much more rational. Temperature dropped to 100° F. Sleeping peacefully.

On March 16 he had a good night's sleep and general improvement was maintained. Nasal and aural discharges almost disappeared, and tongue and mouth much cleaner. Quite deaf. Sinus draining well. Pulmonary accentuation still present: there is still an aortic presystolic bruit. Dilatation still marked, but area somewhat smaller. "S.U.P." repeated.

On March 17 improvement maintained. Blood-culture negative; white blood cells, 12,812; polymorphonuclears 75 per cent.

From March 18 to 25 his temperature remained normal and general condition gradually improved. On the 25th there was no discharge from the sinus, which appeared to be quite healed. Nasal and aural discharges ceased. Very few râles present. Cardiac dilatation much lessened (still pulmonary accentuation and a slight aortic presystolic murmur).

March 28: Improvement well maintained. All discharges have now ceased, but patient is very deaf. Dilatation of the heart still present in a very slight degree. There is accentuation of the pulmonary second sound, but otherwise the heart sounds are normal.



March 28 to April 19: During this period the improvement was maintained. On April 1 he began to put on weight and was, to all appearance (with the exception of deafness), a healthy man on April 13. He was discharged on this date and recommended six weeks sick leave.

Further History: He was readmitted to Tidworth Military Hospital on May 24 complaining of breathlessness on exertion. He had a perforation of the right drum. Chest and heart were normal.

As the E.N.T. specialist did not advise his retention in the Service he was brought before a medical board on June 23 with a disability of otitis media. He was finally discharged the Service on July 1 under King's Regulations, paragraph 370 (xvi) (a).

My thanks are due in large measure to Lieutenant-Colonel W. F. M. Loughnan, M.C., R.A.M.C. (late A.D.P. Southern Command), Major E. B. Marsh, M.C., and Captain G. Anderton for their valuable assistance.

Lieutenant-Colonel G. F. Rudkin, D.S.O., has kindly given me permission to send these notes for publication.

NOTES ON DISINFESTATION OF FURNITURE BY HYDROCYANIC ACID GAS.

A VERY interesting demonstration was given by Dr. Fenton, Medical Officer of Health, the Royal Borough of Kensington, on October 12, at the Borough Disinfestation Centre, Wood Lane.

The apparatus consists of a lorry chassis, having rails on the upper part of the frame, so that an all-metal body or van can be run on and off it on to similar rails at the disinfestation centre.

The metal body or van has a capacity of 570 cubic feet; one half of one side constitutes a sliding door which can be tightly clamped after packing in the articles for fumigation.

At one end of the van is a circular metal plate about ten inches in

diameter, electrically heated, on to which leads a two-way iron pipe, one branch of this pipe opens into the van, the other branch is open to the exterior and is fitted with a screw cap and a detachable funnel. Inside the van is a radiator system of piping which can be connected to electric cables at the disinfestation centre and which heats the air in the van to 100° F., and maintains it at that temperature during the process of fumigation.

At the disinfestation centre where the process is carried out there are two rails on to which the van is run from the chassis. The rails are covered by a corrugated iron roof but are open to the air on all sides.

A powerful electric exhaust fan can be connected up by flexible piping to the iron pipe outlet on the van. During disinfestation the iron pipe is sealed by means of a gas-tight screw cap. The fan extracts the gas and air from the van into a tall chimney thirty feet high, when fumigation is complete.

Method of Use.—Furniture, bedding, etc., are loaded up on the lorry and van at the house at about 7.30 a.m. The bedding is packed in last. On reaching the Centre the bedding is removed to the steam disinfector and the van sealed by clamping the door tight.

The bedding is disinfected by steam owing to the danger of hydrocyanic acid gas remaining in mattresses, pillows, etc. for a long period; it is considered unsafe for individuals to sleep on them the same night.

Next the van is run off the chassis on to the fixed rails under cover. The electric current is connected to the radiator system to heat up the interior. The screw cap is removed from the iron pipe leading to the metal plate at the back and the iron funnel is inserted. Then eight ounces of liquid hydrocyanic acid are passed from a metal bottle into the funnel, which is rapidly removed and the screw cap firmly replaced.

The hydrocyanic acid is evaporated from the heated metal plate and diffuses through the van.

By heating the inside of the van to 100° F. the rapidity of diffusion and the power of penetration of the gas are enhanced. Two hours are allowed to elapse, then the pipe from the electric exhaust fan is connected up and the fan started. There is an inlet pipe in the back of the van to admit fresh air during the process of extracting the gas, this inlet is closed with a screw cap during the fumigation process.

The concentration of gas in the van during the two hours is approximately 3 per cent.; on extraction the gas is so diluted with the external air at the top of the chimney that it is considered safe. Nevertheless as a precautionary measure the height of the chimney should be about thirty feet.

The extraction process is continued for three hours, then the sliding door is opened and the attendant tests the air inside for residual gas. The test consists of placing or holding in the van a piece of filter paper soaked in a mixture of benzidine acetate and copper acetate. If this turns blue

hydrocyanic acid is still present, if it remains white the extraction process is complete. The furniture is then removed, the inside of the van swept out and contents repacked and returned to the owner's house by 4 p.m. the same day.

Not only furniture, but any articles--books, papers, clothing, bedding, leather goods, &c.—can be disinfected without damage.

Attendants.—At the Kensington Borough Station there are two attendants who have had a special course of training for three weeks at the Imperial Chemical Industries Establishment at Birmingham. They are not only instructed in all precautionary measures but in first aid work and resuscitation methods in case of accident.

Attendants during the process wear gas masks; these are obtained from Messrs. Siebe, Gorman and Co. This firm also makes a special apparatus for first aid treatment consisting of an inhalation apparatus with cylinders containing a mixture of oxygen with 7 per cent. CO_2.

Cost.—The cost of the van, apart from the chassis, extraction fan, &c., is £360, constructed by the Metropolitan Cammell Wagon and Finance Co.

The bottles of liquid hydrocyanic acid are sold by the Imperial Chemical Industries, Ltd., at 4s. 6d. per lb.

An Alternative Method.—Another less accurate method has been used at the same disinfestation centre. The ordinary all-metal refuse collecting vans are packed with the furniture or other articles and sealed by pasting strips over all openings, leaving the door at the rear till the last.

Cardboard discs the size of small plates, impregnated with hydrocyanic acid, are obtained from the Associated Fumigators, Ltd., packed in airtight tins. These tins are opened and the discs thrown at random in amongst the packed articles and the van door hastily sealed. The attendant during the process wears a gas mask.

After four hours the van is opened up and left in the open air for the dissemination of the gas. I was informed that this method has proved satisfactory, but the disadvantages as compared with the specially constructed van are obvious.

Travel.

FROM SINGAPORE TO NORTH CHINA AND JAPAN.

By Major J. R. HAYMAN,
Royal Army Medical Corps.

(*Continued from p.* 413, *vol. lxiii.*)

After this, we visited some Chinese stores and then returned to the hotel. On the following morning, May 10, we visited other parts of the Concession areas. It was rather a surprise to find Indian shops, Madrassi and Sindhi, so far afield, dealing in the usual silk commodities. In the afternoon we caught the 4 p.m. train to Pekin.

The country was one continuous arid flat stretch. In parts, the land had been extensively tilled, but there appeared to be a conspicuous scarcity of habitations or villages. One wondered how the owners or tenants of the land were able to define their boundaries, as there were no obvious signs of hedgerows or landmarks. As we approached Pekin we caught glimpses of the Western Hills lying to the north. After we had been travelling for three hours we passed through an opening in the Southern Wall of the Chinese city of Pekin. The train then continued in a half circle through the eastern side of the Chinese city and stopped at a station which is situated on the southern side of the wall adjoining the Legation Area. A hotel porter from the Hôtel du Nord met us at the station. Our kit was carried through a gateway in the Wall to a taxi waiting in the Legation Area. The taxicab proceeded through the Legation Area, and then into Hatamen Street in the Tartar City. Suddenly it turned off from the main street and went down through a narrow and forbidding alley-way and stopped. A sign over the doorway indicated that this was the entrance to the Du Nord hotel.

Passing through a dimly lit corridor we entered the hotel lounge which seemed to be entirely occupied by Chinese of the student class. We then asked to see the bedrooms and were agreeably surprised to find that they were very clean and well furnished. Also that each room had a bathroom with modern sanitation attached. Though a little noisy, the place was on the whole quite comfortable and the food good.

Apropos of our experience in this matter, it might be mentioned that there are two first-class hotels in Pekin: one, the Wagons Lits, situated in the Legation Area near the station, and the other, the Grand Hotel du Pekin, situated just north and outside the Legation Area. After dinner we arranged with two rickshaw boys to drive us round the sights of Pekin for the three days that we expected to be there. Their charge was $1.00 (1s. 3d.) a day. They were cheerful, willing fellows, who spoke broken and scarcely intelligible English with an American accent.

One might wonder why such a city as Pekin ever existed as it lies in the middle of a flat and somewhat arid plain, miles from a river. It must have had some strategical value owing to its proximity to the warring tribes of the north. It depends for its food supply on local resources, and obtains its water supply from shallow wells in and around the city. In spite of its slummy and congested area, and its archaic form of sanitation, it remains a reasonably healthy town. This must be due to the dry climate, the extreme cold in the winter, and the sun's rays in the hot months. The city is subject to severe dust-storms which blow across from the desert areas on the west. Pekin is divided into two main cities by an intervening wall running east and west. On the northern side of the wall is the Tartar city, constructed in the form of a square, four miles on each side. On the southern side is the Chinese city built in the form of a rectangle five miles by three. Enclosed within the Tartar City is the

FIG. 4.—An entrance to Imperial City.

Imperial City, also built in the form of a square, roughly one and a third miles each way. Within this, again, is the Forbidden City, rectangular in shape, measuring 3,000 by 2,300 feet. Each city is enclosed within its own protective wall, rising on an average 35½ feet and having a breadth of 50 feet. In addition, the Forbidden City is surrounded by a moat with a breadth of approximately fifty yards.

Adjoining the northern aspect of the intervening wall, and lying between the wall and the Imperial City, is the Legation Quarter. It covers an area approximately equal to that of the Forbidden City. Its protective walls on the north, east and western aspects are comparatively insignificant, though presumably effective.

Incidentally, one portion of this wall shows evidence of the bombardment during the Boxer Rebellion in 1900, and an inscription has been erected at the spot, with the words :—

"LEST WE FORGET."

The history of Pekin dates from 2600 B.C. Since that time it has known innumerable vicissitudes, having been built and destroyed, rebuilt, attacked, sacked—but always, like the proverbial Phœnix, it manages to rise from its ashes. Also, it has known over sixteen dynasties from different warring centres, who have in turn fought for it, held it and then lost it. It was captured by the Allied European troops during the China War of 1860, and again during the Boxer Rebellion in 1900. During these episodes, it became in turn a capital and a provincial city, and has either expanded or contracted according to the needs of the period.

Our first morning in Pekin (May 11) was spent in and round the Legation Quarter. The entrance gates are guarded by local Chinese policemen. It was a positive relief to get away from the hot, dusty, stifling crowded roads of the Tartar City, and enter the quiet, shaded, well-paved streets of the Quarter. The Quarter itself is subdivided into walled-off areas for the Legations and guards of the different nationalities, British, American, French, German, Spanish, Russian, Portuguese, Italian, Belgian, Austrian, Danish, Swedish, Japanese, and may be others.

The entrance gate to each Legation has its own national guard, which gives it a secluded monastic effect. The British Legation seems to cover a fairly extensive area, and has barrack accommodation for one company from the battalion stationed at Tientsin. The British Minister has his residence here.

We made the usual calls and were fortunate to meet Colonel and Mrs. Wilkinson, who were able to give us some very useful information about places that were worth seeing.

Outside the Legation Quarter is a wide area of "dead" ground. At the time it seemed rather paradoxical to find a company of Japanese soldiers practising rifle and machine-gun exercises on this ground in full view of the passing Chinese population!

In the afternoon, we told our rickshaw boys to take us to the Imperial and Forbidden Cities. One of the boys acted as our guide, and probably we therefore missed a lot of the things "that one ought to see."

Passing through the entrance gate of the Imperial City, he first took us to a collection of large earthenware urns in which were swimming a most weird and wonderful collection of "gold"-fish. We then strolled through a dusty park adjoining the artificial lake. The most noticeable features of this area were some restaurant kiosks. On the far side of the park is the moat that surrounds the Forbidden City. This we crossed by a bridge, and then entered the Forbidden City by the Western Gate. It is a massive portal and its strength gave one food for reflection. We then drove in our rickshaw through one of the outer courts leading to the elevated causeway on which the three celebrated throne halls are built. They are constructed in the form of pavilions, and were used for the most important State functions. The roofs are covered with polished yellow tiles, and when seen from a distance make an imposing sight. A closer view, however, is rather disappointing.

The walls are built of stone and painted red. The roofs are supported by massive wooden columns, and the eaves are very highly decorated and painted.

A close view tends to make them look tawdry. The measurements of the first hall, or pavilion, are given as: 100 feet wide, 200 feet long and 100 feet high. This was considered the most important of the three pavilions and contained the famous Dragon Throne.

Passing through this pavilion we entered a spacious paved courtyard, and going along the causeway we reached the second pavilion. This more or less resembles the first in size and structure. The third pavilion is of similar design. Since China became a Republic, the buildings in the

Fig. 5.—The first and most important pavilion—the Dragon Throne Room.

Forbidden City have been utilized as exhibition rooms for antiques and general museum purposes. However, on the approach of the Japanese forces, most of the exhibits had been, or were in the process of being, packed, crated, and sent to Shanghai for safe custody. Consequently, the little that was left on view was not worth description. In any case, rumour has it that during the last ten years, while there have been constant revolutionary wars, most of the articles of real intrinsic value and interest have wilted away or have been replaced by imitations. On the courtyard terraces there are some very large bronze urn incense burners, standing some five and a half feet high and about four feet diameter. It is said that they were originally coated with gold, but that some enterprising personage in authority took the pains to have this scraped off!

That the Forbidden City generally is gradually going to rack and

ruin is the opinion of those who have seen it in better times. Flanking either side of the elevated causeway are low two-story corridor-like buildings, which presumably were apartments for the Royal Household. Throughout the grounds are many other somewhat insignificant buildings scattered about. While the idea of comfort is a relative term, there appears to be little in the Forbidden City to attract one from the point of view of a residence, except the quietness, seclusion, and freedom from the noisome smells of the surrounding slums.

Leaving the pavilion area, we passed through the adjoining gardens and then left the city by the Eastern Gate. Crossing the bridge over the moat, we found ourselves once again in an ill-paved dusty street flanked on either side by rickety one- or two-story wooden houses or improvised

Fig. 6.—One of the gateways of Pekin.

shops. Along the roadway is a jostling mass of sweating humanity, rickshaws galore, noisy trams, shrieking taxis, squeaking carts, cyclists and a miscellaneous collection of other vehicles. The local inhabitants are definitely of a sturdier type than one usually sees in the south of China. Mixed in the crowd are Mongols, and others, whose place of origin is presumably further north or west.

A large percentage of the women still have their feet bound tightly, and hobble along as if walking on stilts.

One might have pictured Pekin as one vast congested slum, but it is curious that there are a number of open spaces intervening between the slummy areas. And, while the alley-ways and streets in these areas are narrow, dirty and forbidding, the main thoroughfares of the Tartar City are straight, wide roads, which with some care and maintenance could be rendered as fine as those of any other city.

The shopping centres tend to be aggregated in different areas according

to the class of goods that they sell. For example, the jade merchants collect round Jade Street, the silver merchants round Silver Street, and the same applies to Embroidery Street, Lantern Street, Furniture Street, &c. Consequently the prospective buyer may have to spend some time going from one area to another. The " streets " are actually mere alley-ways, and poor ones at that. The shops themselves have a ramshackle appearance from the outside, while the interior may be most attractively laid out, and contain a much better selection of goods than one could possibly anticipate.

The next morning, May 12, we started off early to visit the Lama Temple which is situated in the north-east corner of the Tartar City. The three-mile rickshaw drive throughout the length of Hatamen Street was

FIG 7.—Pekin—a main thoroughfare.

more instructive than enjoyable. We passed strings of camels carrying coal or other merchandise. We also passed an infantry platoon which was marching in fairly good formation, the only occasion on which we saw any attempt at drill order among the Chinese troops who were usually to be found lounging or squatting about the roads and other places in a dishevelled kind of uniform.

The Lama Temple is a Buddhist monastery. Lord Curzon described the place as having an unenviable reputation for dirt, vice, rapaciousness and anti-foreign feeling. Consequently it was rather a relief to find the Temples and courtyards clean at least. The older monks more or less ignored us, but the young ones—and some of them were little more than boys or youths—seemed quite friendly disposed, and took a considerable interest in the cameras. We were just in time to see the commencement

of the morning service in the main temple. A Buddhist temple has a fair resemblance to a Christian church without the nave. The altar is in much the same position and the choir seats are occupied by the congregation of monks. Two high priests officiated and led the prayers. They walked up and down between the seated rows of monks. Their elaborate vestments resembled those seen in any "high" Christian church, and the hat or biretta was shaped like a very exaggerated form of fireman's helmet. At a distance, the intonation of the chants and responses might have been mistaken for that of a Christian service. No resentment was shown as we watched them at prayer. We then visited some of the smaller temples in the main courtyard. The procedure was the same in each instance. The priest or monk would show us any tiny object of particular interest in each place, and then lead us to the image of a Buddha, before which we were each expected to light an oil candle. The priest would then intone a prayer which was to bring us "Long life, good fortune and good health." After which he would expect a small gratuity. We came back to the main temple at the close of the service which had lasted about forty minutes. The monks filed out, and some proceeded to their living quarters, while others passed on to some adjoining temple.

It was rather an impressive sight to see these men in their shabby reddish cassock-like garments, their heads shaved, passing along with a solemn, subdued, meditative expression on their faces. Overhanging the courtyard horizontally was a long stretch of thin wire or string, to which were attached pieces of paper inscribed with prayers. We were offered small prayer-wheels as curios.

Leaving the Lama Temple our rickshaw boys took us to see the Drum Tower which was built in A.D. 1272. It stands 130 feet high. Except that one can get a very good view of the northern part of the city from the top of the Tower, there is nothing of particular interest in the place. Somewhere in the same vicinity is the Bell Temple in which is a bell seventeen feet high and thirty-four feet in its widest circumference. The story goes that when it was cast it was found that the tune was unsatisfactory. The local soothsayer then declared that it required the blood of a virgin. So, when it was melted down again the bell-smith's daughter voluntarily leaped into the seething cauldron. Since then, the tone has been so good that one can even distinguish the dying sobs of the girl martyr. The sound made by the bell when it was struck was supposed to travel thirty-three miles. Anyway, we did not see this bell, nor did we hear it being struck. Instead, we wended our way to the Jade Temple, situated on the western side of the Imperial City. Possibly it was an unforgivable sin on the part of a tourist to pass by the famous "Coal Hill" overlooking the northern part of the Forbidden City, without even a casual inspection, but we were thirsty and weary.

The Jade Temple is a small building containing a four-foot statue of Buddha, carved out of a block of white jade. The vestment portion is

studded with sparkling gems. To obtain a better view of the statue, an arrangement has been made to flood-light it with an electric lamp. The white jade might then be easily mistaken for marble.

Near the Jade Temple is the entrance to the Winter Palace and grounds. These are cleverly laid out with the help of an artificial lake, or rather three artificial lakes according to the guide book. On the far side of the lake is a relatively small hill on which are built a number of comparatively small pavilions.

This apparently constitutes the local idea of a palace. However, the combination of the lake, and the pavilion-studded hill makes a pretty and effective scene. It is related that the old Dowager Empress had a special pavilion constructed where she could give audience to foreigners, in order that her own palaces should not be desecrated by those "barbarians"!

(*To be continued.*)

Current Literature.

FAIRLEY, A., LINTON, E. C., and WILD, F. E. **The Absorption of Hydrocyanic Acid Vapour through the Skin.** *The Journal of Hygiene.* 1934, v. 34, pp. 283-94.

This interesting paper records the results of an investigation made at the Experimental Establishment, Porton; results which are important in view of the increasing use of hydrocyanic acid for disinfestation.

The conclusions arrived at were as follows:—

(1) Even in a small apparatus, a concentration of hydrocyanic acid cannot be expected to maintain its initial, or calculated, level without frequent additions of fresh liquid acid. This tendency to a fall in concentration is increased by the presence of moisture, or by using clean apparatus which has not yet absorbed its quota of hydrocyanic acid, and probably by other factors.

(2) An atmosphere saturated with hydrocyanic acid is readily absorbed by a skin surface amounting to $\frac{1}{60}$ of the body area in the guinea-pig, and will produce death if the exposure be prolonged.

(3) Atmospheres containing hydrocyanic acid, in different concentrations, readily pass through the skin of a rabbit, which, with its respiratory system protected or excluded, can just tolerate a concentration which averages 1 : 210 for ninety minutes.

(4) Sodium thiosulphate afforded a definite but limited degree of protection against the effects of skin absorption of hydrocyanic acid, in that it approximately doubled the time of exposure without symptoms, except in high concentrations.

(5) Owing to the great volatility of hydrocyanic acid, danger resulting from spilling the liquid on the bare skin appears to be slight so long as there is complete freedom for evaporation.

(6) In the absence of the odour of the drug, acute poisoning with hydrocyanic acid does not appear to produce any post-mortem appearances, either macroscopic or microscopic, which are characteristic, or from which a diagnosis can reasonably be made.

Gutnic, A. Prophylaxie spécifique de la coqueluche. (Contribution à l'étude critique.) **A Critical Study of the Specific Prophylaxis of Whooping Cough.** *Thèse de Paris,* 1934. No. 256, 44 pp. [27 refs.]

The diagnosis of whooping cough in its early stage is clinically impossible, and can only be made by the bacteriological method commonly employed in Denmark but little in use elsewhere, which consists in making the patient cough over a special medium from which the Bordet-Gengou bacillus is cultivated in a high percentage of cases. Gutnic suggests that the method might be made available to every practitioner by creating stations for the bacteriological diagnosis and prophylaxis of whooping cough as in Denmark. As soon as the diagnosis has been made the child should be isolated until the end of the paroxysmal stage, after which he may be allowed to return to school. All susceptible contacts should be protected by vaccination or serum prophylaxis. The results of vaccination have hitherto been inconstant, but the best results are obtained by the use of recently isolated strains and highly concentrated microbial emulsions. Convalescent serum has been recommended by Debré, but is not on the market, and is very difficult to obtain. Experiments made on animals show that anti-endotoxic serum has an undoubted value. Teissier, Rivalier, Reilly and Cambessédès immunized animals (sheep and asses) with pertussis endotoxin and after bleeding them obtained a serum which neutralizes active endotoxin. After injection of a guinea-pig with a quantity of virulent endotoxin and a slightly higher dose of anti-endotoxic serum than that which neutralizes the same quantity of serum *in vitro,* no change takes place in the general condition of the animal and the characteristic sloughing ulcer produced by unneutralized endotoxin does not occur. The prophylactic value of this serum has thus been proved experimentally, but has apparently not yet been tested clinically.

J. D. Rolleston.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 10.

Shope, R. E. **The Infection of Ferrets with Swine Influenza Virus.** *J. Exper. Med.* 1934, v. 60, 49-61, 2 figs. on 1 pl.

Smith, Andrewes and Laidlaw have obtained from cases of influenza in man a virus that is pathogenic for ferrets. They further observed that the virus of swine-influenza was infective for ferrets, and produced in these animals a disease similar to that caused by the virus of human origin. The present paper confirms and extends these observations, as regards the

infectivity of swine-influenza virus for ferrets (this *Bulletin*, 1933, v. 8, 697).

In accordance with the results of Smith, Andrewes and Laidlaw it was found that swine-influenza virus caused a characteristic disease in ferrets when injected intranasally, but not when administered subcutaneously, indicating a tropism of the virus for the tissues of the respiratory tract similar to that already observed in swine. A disease that was clinically more severe, and pathologically more extensive, was produced when the intranasal inoculation was performed under ether anæsthesia. Animals infected in this way developed an œdematous type of lobar pneumonia that sometimes terminated fatally. After serial passage through sixteen ferrets the virus was found still to be capable of inducing swine-influenza when mixed with *Hæmolytica influenzæ suis* and administered intranasally to swine. Serum from pigs recovered from swine-influenza neutralized the ferret-passaged virus for either swine or ferrets. Similarly, serum from recovered ferrets neutralized the swine-influenza virus for either ferrets or swine.

W. W. C, Topley.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 10.

Ministry of Health. **Accidents in Sewers. Report on the Precautions Necessary for the Safety of Persons Entering Sewers and Sewage Tanks** [Hetherington, R. G., Chairman]. 12 pp. 1934. London: H.M.S.O. [2d.]

Accidents occur from time to time in sewers and sewage tanks from flooding and from gases which may be asphyxiating, poisonous or inflammable. Flooding due to storms and abnormal tide action cannot be guarded against, except by the alertness of the men; but when due to sudden releasing of large volumes of sewage, it is caused by remediable lack of co-ordination among the staff. Sewer air may become asphyxiating owing to an excessive content of carbon dioxide arising from fermentation of sewage solids and to diminished content of oxygen arising from absorption of the atmospheric oxygen by the sewage or its dilution with fermentation gases. These gases consist of a mixture of methane (60 to 80 per cent) and carbon dioxide (15 to 20 per cent). Breathing becomes impossible when the oxygen is diminished to values between 10 and 6 per cent. Sulphuretted hydrogen may also be evolved to a poisonous amount; it is dangerous to health when present to the extent of 1 volume in 10,000 of air, and at 1 volume in 1,000 is rapidly fatal. Explosive mixtures may collect in sewers due to direct admission of coal gas from neighbouring leaky gas pipes, or due to petrol discharged into sewers. An air-petrol mixture containing 2 to 3 per cent of petrol vapour is highly explosive; 1 volume of liquid petrol gives rise to about 160 volumes of vapour. In the past too little notice has been taken of these possible dangers. No man should enter a sewer or tank before it has been ventilated and the air has been tested with moistened lead acetate paper for sulphuretted hydrogen, with a safety lamp for asphyxiating

conditions, and with a detector lamp for inflammable gases. A life line should be worn by the first man entering. A rescue kit should be carried by each travelling sewer gang. Each man should be certified to have been trained in the use of the tests and the precautions to be taken.

E. L. COLLIS.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 11.

(i.) RUYS, A. CHARLOTTE, and SCHÜFFNER, W. A. P. De waarde van absorptieproeven voor de serologische diagnose van verschillende leptospira infecties. [**The Value of Absorption Tests for the Diagnosis of Different Leptospira Infections.**] *Nederl. Tijdschr. v. Geneesk.* 1934, v. 78, 3110-14. French summary (3 lines).

(ii.) VAN THIEL, P. H. De wijze van besmetting bij de ziekte van Weil. [**The Mode of Infection in Weil's Disease.**] *Ibid.* 3115-22. English summary.

(i.) As a rule in the classical and ubiquitous form of Weil's disease there is no difficulty with serum diagnosis, for a well marked agglutination and lysis reaction is obtainable to the causal strain of *L. icterohæmorrhagiæ.* But there are strains, notably "Rachmet" and "Salinem" from Sumatra and the dog strain of Klarenbeek and Schüffner, which do not react serologically to titre strength and yet show the presence of co-agglutinins and co-lysins. This want of reaction to final titre does, of course, itself differentiate these strains, but occasionally it fails. For this reason the authors have applied the absorption test, as it is used in bacteriology. To carry out an absorption test the lysis, which accompanies the agglutination test, had to be got rid of and this was effected by the addition of formalin to the test suspension. A well-grown culture was killed by the addition of ½ per cent pure formalin and this suspension, in tubes containing two cubic centimetres, was centrifuged for two hours at 3,500 revolutions. The sediment was taken up in a pipette from a number of tubes and nine drops delivered into a small test tube. After cleansing the pipette one drop of test serum was added to the nine drops, the test tube corked and the whole kept for four hours, or better till next day, at room temperature. The tube is then centrifuged for twenty minutes at 3,500 revolutions and the clear supernatant fluid used, in the ordinary way, for absorption tests. Tests were applied in a number of cases and showed that the absorption test can overcome the difficulty created by an occasional paradoxical agglutination reaction.

(ii) The common history of a case of Weil's disease in Holland is of a previous fall into water. Now canal and ditch waters have been shown to contain *L. icterohæmorrhagiæ,* derived from the urine of rats which are leptospira carriers. It has also been demonstrated that infection can occur through intact human skin, but more certainly if abraded. Spirochætes can also penetrate through mucous membranes. That drowning persons acquire the disease more frequently than bathers or swimmers is attributed

5

to the fact that greater quantities of water are swallowed and aspirated by them than by bathers and swimmers. The question raised by the author has reference to the most frequent mode of infection, which he considers to be *via* mucous membrane rather than by skin. The epidemic of Weil's disease in Lisbon in 1932, with 126 persons infected by drinking water, supports this view. So does the contention that swimming with the crawl stroke and with the Spanish stroke, involving under-water progress and also swallowing of infective water, facilitate the infection.

The matter was put to the test on guinea-pigs and rats. Infective matter was applied to scarified or shaven skin, through the mouth, through the nose and on the eye. These experiments are not very numerous and it may not be legitimate to transfer them to the case of man, but so far as they go they seem to show that infection is more easily brought about by the nasal route and also through the conjunctiva than by swallowing.

W. F. HARVEY.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 11.

SINGLETON, W. **Recent Developments in Lead Pipe for Water Services.** *Water and Water Engineering.* 1934, v. 36, 235-8. [Summary taken from *Pub. Health Engineering Abstr.* Wash. 1934, v. 14. Signed J. K. HOSKINS.]

This paper, read before the Scottish section of the Institution of Water Engineers, March 16, 1934, discusses the properties of water pipes made of lead to which a small amount of tellurium has been added.

Tellurium lead is ordinary, pure lead to which has been added about 0·05 per cent of tellurium or one part in 2,000 parts of lead. Two new properties of this material are (1) the ability to develop nearly double the strength of ordinary lead when strained, and (2) extremely fine and uniform grain. Data are presented to show the greater strength of tellurium lead pipe when tested for hydraulic bursting, failure when filled with freezing water and failure under vibration. Experiments with water from many sources have shown that tellurium lead has much greater resistance to solvent action than has ordinary lead and that this superior resistance is most marked in waters of high plumbo-solvent action.

Tellurium lead is soft and easy to work, is tough and can be soldered the same way as ordinary lead. All the valuable properties of tellurium lead are obtained without the loss of the desirable features of ordinary lead.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 11.

Reviews.

PRINCIPLES AND PRACTICE OF NEUROLOGY. By Alexander Cannon, M.D., Ph.D., D.P.M., and E. D. T. Hayes, M.D., D.P.M. London: William Heinemann (Medical Books), Ltd. 1934. Pp. xx + 333. Price 25s. net.

The appearance of a new textbook of Neurology is an event of interest, as the English medical literature on this subject has up to the present been starved in comparison with the wealth of writing in other branches of medicine.

This work comprises some 333 pages of quarto size, and is printed in very clear type and illustrated throughout by numerous diagrams and photographs.

The authors are fortunate in being able to include a chapter on the clinical examination of the nervous system by Professor Monrad-Krohn of Oslo, a chapter which is so complete, so clear, and excellent in every way that our only regret is that it has not come from the pen of an English author.

The book deals with neurological disease in an efficient and interesting manner, and contains innumerable pertinent observations of great help to the reader in obtaining a clear idea of the subjects dealt with. We feel here we are reading a book which is the outcome of a long experience of clinical neurology—a book which once taken up it is difficult to lay aside. The descriptions are not so long as to become wearisome and yet all the essentials are adequately covered. The authors are to be congratulated on a work for which we prophesy a great demand. J. H.-S.

THE ÆTIOLOGY AND TREATMENT OF SPASMODIC BRONCHIAL ASTHMA. By H. Gordon Oliver, M.D. London: H. K. Lewis and Co., Ltd. 1934. Pp. vii + 48. Price 2s. 6d. net.

In a monograph of some 48 pages the author puts forward an ætiological theory regarding bronchial asthma. Dr. Oliver finds in his series of cases that spasmodic bronchial asthma is associated with the presence of a round monilia in the sputum in such a high percentage of cases that a causative significance is to be attached to its presence with regard to this disease.

While we prefer to associate ourselves with the cautious attitude adopted by Dr. Langdon Brown—who writes a foreword to the book—we would point out to the author that in other diseases a similar state of things exists, for example in sprue, which was long thought to be caused by a monilia after Ashford had demonstrated the constant occurrence of *M. albicans* in the mouth scrapings and in the stools.

As regards treatment, the author insists upon a saturation iodide therapy combined with vaccine. It is just the exact effect or otherwise of the vaccine used alone upon which his theory depends for its acceptance.

It is an interesting little book and reflects credit upon the author.

J. H.-S.

PHYSIOLOGY OF THE CENTRAL NERVOUS SYSTEM AND SPECIAL SENSES. By N. J. Vazifdar, L.M. & S. Bombay: Ideal Books Co. London: H. K. Lewis and Co., Ltd. 1934. Pp. viii + 341. Price 10s. 6d. net.

This book, now well known in India, appears in its sixth edition, which follows the lines of previous ones, but has been brought up to date.

It is a very useful work devoted to the explanation of very difficult subject matter—the anatomy and functions of the nervous system.

The book is well illustrated by numerous diagrams and tables, and the subject matter is treated in a clear and concise manner. It is a work which will be of great use to students and also to those specializing in nervous and mental diseases.

EXPERIMENTAL BACTERIOLOGY AND ITS APPLICATION TO THE DIAGNOSIS, EPIDEMIOLOGY AND IMMUNOLOGY OF INFECTIOUS DISEASES. Vol. I. By Dr. W. Kolle and Dr. H. Hetsch. English version incorporating further revision. Edited by Professor John Eyre. London: George Allen and Unwin, Ltd. 1934. Pp. 592. 118 plates and 200 text figures. Price 30s. net.

The appearance of an English translation of this well-known textbook on experimental bacteriology is to be welcomed. As noted in the foreword, the translation has endeavoured to conform to the Germanic character of the original and Professor Eyre is to be congratulated on having achieved success in this respect.

The volume opens with the general consideration of the morphology and biology of pathogenic organisms; this is followed by a review of immunity problems and the various antibodies concerned in the defensive mechanism of the animal body. Serological diagnostic methods are fully discussed, and a useful chapter on vaccine and serum therapy is included.

The succeeding chapters deal with specific bacterial infections and an important feature is the very full consideration given to animal diseases which emphasizes the value to be gained by a study of comparative bacteriology.

The book is profusely illustrated and the coloured plates are excellently produced. It can be strongly recommended as a comprehensive volume of bacteriology.

H. M. P.

Correspondence.

CONVERSION OF LORRIES INTO MOTOR AMBULANCE CARS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The conversion of lorries into motor ambulance cars, as suggested by Lieutenant (Qr.-Mr.) R. D. Ballard, in the Journal, Vol. LXIII, No. 4, page 262, will not recommend itself to those who have had objective and subjective experience of improvisations of this sort in actual war.

In the first place lorries are provided for the transport of inanimate things and persons who are well, and are totally unfitted for transport of sick and wounded. Even the well-sprung ambulance cars of the Service transmit shocks to seriously wounded which at times cause great distress and suffering.

Furthermore, the work of the R.A.S.C. should not be interfered with by diverting vehicles from their normal use. It may be taken for granted that the War Equipment Tables are drawn up having in mind the actual requirements of supply and transport of goods and fit personnel. The transport of sick and wounded is a matter for the R.A.M.C.—or at least should be.

The Canadian Military Institute,
Toronto.
November 17, 1934.

I am, etc.,
F. S. L. FORD,
Colonel.

THE POSSIBLE INEFFECTIVENESS OF THE GASTRIC SECRETION IN THE PREVENTION OF INTESTINAL AFFECTIONS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—A letter has appeared in your last issue on the subject of the importance of achlorhydria in increasing susceptibility to intestinal infections owing to the absence of the normal "acid barrier" furnished by the gastric secretion. In it attention is directed to a statement of Dr. Hurst regarding the antiseptic action of the hydrochloric acid of the gastric juice and the suggestion is made as to its possible exploitation in the prevention of intestinal diseases.

It has, of course, long been a matter of common knowledge that any deficiency in the percentage of physiologically active hydrochloric acid in the gastric secretion, either by its inhibition or dilution, facilitates the passage of pathogenic organisms through the stomach. It would appear, however, that an alternative method of invasion by pathogenic intestinal bacilli is less well known.

Experimental investigation has shown that if bacteria are introduced directly into the small intestine at a level at which neutralization of the gastric juice has occurred they may survive for a long period. The normal intestinal mucosa is, however, practically impermeable to organisms. Should small numbers of bacilli penetrate they are quickly destroyed in the mesenteric lymphatic glands. It has, further, been demonstrated that pathogenic bacteria can pass through the uninjured bucco-pharyngeal mucous membrane. Following this portal of entry these bacilli have been isolated from the cervical lymphatic glands from whence they invade the blood. The path of elimination has been shown to be *via* the intestinal tract.

If the experimental evidence adduced in support of this view is accepted, it will be obvious that an absence or a deficiency of hydrochloric acid in the gastric secretion may not be the only predisposing factor to these infections.

In the letter to which I refer the suggestion has been made that test meals might be given "to troops in a station abroad where an outbreak of these intestinal diseases is threatened." Apart from the very doubtful practicability of the suggestion, the fact that there is an alternative route of invasion of pathogenic organisms would render this procedure, which is likely to prove far from popular, of questionable value.

Royal Army Medical College,
Grosvenor Road,
*London, S.W.*1.
December 29, 1934.

I am, etc.,
H. MARRIAN PERRY, *Colonel,*
Director of Pathology.

Notice.

KING EDWARD VII. CONVALESCENT HOME FOR OFFICERS AT OSBORNE.

OSBORNE HOUSE, East Cowes, Isle of Wight, formerly the Island home of Her Majesty the late Queen Victoria, was given to the Nation by H.M. King Edward VII. as a Convalescent Home for Officers.

The House, which is situated on the Solent in an exceptionally beautiful park of 450 acres, was duly converted into a most delightful and comfortable Convalescent Home for the reception of convalescent officers, both serving and retired, of the Royal Navy, Royal Marines, Army, Royal Air Force, Royal Indian Navy and Indian Army, and of cadets of the aforementioned Services, and, under certain conditions, of both serving and retired Civil Servants who, owing to the nature of their duties, have to serve abroad.

A staff of fully qualified nursing sisters, masseurs, etc., is employed and special facilities are available for dietary, massage and electrical and light treatment. Medical attendance is free, but in case of special nursing or other special measures or special drugs, a charge is made to cover the cost.

Massage, diathermy, ionisation, radiant heat, ultra-violet rays and all electro-therapeutical treatments are provided at a charge normally of 2s. 6d. per week.

The organization of the Home, however, is such as to eliminate, as far as practicable, the atmosphere of Service discipline and it combines all the advantages of a first-class Convalescent Home with those of a Country Club for those patients who, in the later stages of convalescence, are able to take full advantage of the recreational facilities provided.

Osborne has its own private golf links within the grounds about three minutes walk of the House, and the Club, which is second to none in the Island, has its own resident professional. There are also hard and grass tennis courts, a croquet lawn, bowling green, badminton court, miniature rifle range and also a private bathing beach on the estate. During the season the 4½ ton sloop "Osborne" is available daily for yachtsmen, and during the winter months the Isle of Wight Foxhounds meet four days a week, and the foot beagles on two days. Officers may hunt with the latter pack free of charge.

Frequent entertainments, theatricals, and dances are held throughout the year in the recreation room, which is provided with a piano, radio-gramophone and cinema. A silence room is provided for those who desire quietude.

Osborne has also its own motor car which conveys patients free of charge to and from the railway station. The car is available for long and short runs at a small charge. Garage accommodation is available for patients bringing their own cars.

The charges payable are very reasonable and are as follows: (*a*) Cadets and certain subordinate officers and officers on half pay, 4s. 6d. per day; (*b*) all other officers, 6s. per day; (*c*) civil servants, 10s. per day.

For further particulars and booklet apply to the House Governor, Osborne House, East Cowes, Isle of Wight. Telegraphic address, "Convalescent Cowes." Telephone number, Cowes 251.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

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Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette.*"

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Journal

of the

Royal Army Medical Corps.

Original Communications.

THE MOHMAND OPERATIONS ON THE NORTH-WEST FRONTIER OF INDIA DURING AUGUST AND SEPTEMBER, 1933, FROM THE POINT OF VIEW OF THE HEALTH OF TROOPS AND THE PREVENTION OF DISEASE.

BY MAJOR A. E. RICHMOND, O.B.E.,
Royal Army Medical Corps.

GENERAL REMARKS.

THE independent Mohmand country lying eastwards of the Khyber Pass and bordering the Peshawar District in a portion of its frontier boundary is occupied by that part of the Mohmand tribe which is not subject to Afghanistan.

These independent Mohmands are divided into an upper and a lower clan, the depredations and aggressiveness of the former at the expense of the latter at times threatening the peace of the frontier.

The operations to be discussed and initiated in the summer of 1933 had as their object the exaction of retribution from the upper Mohmands on account of recent offences, and the construction of a new road leading from our main frontier highway in the neighbourhood of Shabkadr into the roadless and mountainous Mohmand country.

GEOGRAPHY AND TOPOGRAPHY.

The country is, on the whole, wild and barren and comprises rocky hills and crags, alternating with dusty sun-baked plains, the latter intersected by deep nalas which are dry except in rainy periods.

The valleys 2,000 to 2,500 feet above sea level are for the most part narrow and enclosed, lying between steep hill-sides, while the hills themselves are, on the average, some 3,000 to 6,000 feet in height.

In the more limited area in which the operations took place, an important feature is the Gandao Kwar, a stream which, originating in the hills around the Galansi plain, makes its way by tortuous course in a broad and broken nala, and then, skirting the foot of the Karappa Kandao, flows down a winding valley which borders the new road to a greater or lesser degree throughout its extent, until it debouches from the hills into the Peshawar plain.

This ever-present stream of clear spring water which may vary much in volume, on account of rain or melting snows, and overgrown, as it normally is, with rushes, reeds, and other greenery, forms an ideal and extensive anopheline mosquito breeding area in the summer and autumn months.

CLIMATOLOGY.

From the beginning of May to the end of September the valleys are oppressively hot, and the conditions are very trying to troops on the march along them, while dust storms of a most virulent description occur from time to time in the hot weather, especially during July and August.

Such rainfall as occurs usually comes in the autumn or winter.

In October, November and March, the climate is cool and bracing. Intense cold is a feature of December, January and February, with snow above a height of 3,000 feet, and piercing winds blowing down the valleys.

On account of the intense heat, operations should not take place between June and September; but where man proposes, the Mohmand at times disposes, as was the case at the end of July, 1933, when the operations we are considering had to commence at short notice at a time when existing atmospheric conditions of heat and humidity had reached a climax, and when all the omens indicated a really bad malaria season, orchestrating the difficulties of climate and terrain with which the Mohmand Force was faced.

EPIDEMIOLOGY.

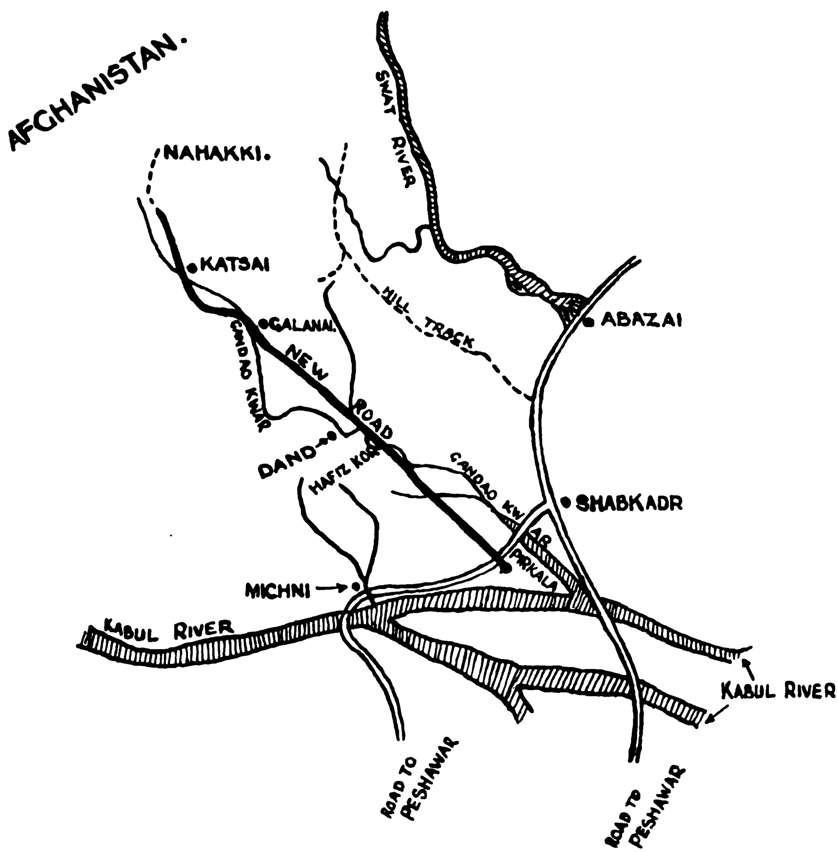
The country is sparsely inhabited. Malaria is endemic and at times epidemic, while cholera occurs from time to time particularly in the spring. In this connection it may be recalled that, during the 1908 campaign, cholera completely immobilized two British battalions and a number of Indian troops. In this campaign, also, pneumonia was prevalent, caused chiefly by chills and by the dust which is septic and irritating to the lungs.

Dysentery, diarrhœa and fevers of the enteric group are normally present to a greater or a less degree in the civilian population of the country, and necessitate constant watchfulness in the warmer months when troops are operating in these regions.

General Outline of the Course of the Operations.

On July 30, 1933, the Peshawar Brigade Column marched out and reached Pirkala.

Sketch Map of Area of Operations, Mohmand Force, 1933.



On July 31, 1933, Headquarters and part of the Nowshera Brigade Column arrived at Pirkala, and the Peshawar Column at Dand.

On August 1, 1933, the Peshawar Column reached Galanai, and the

Nowshera Column was at Pirkala with the exception of one battalion at Dand.

On August 3, 1933, Pirkala Camp was closed and the Nowshera Column concentrated at Dand. Thereafter the Peshawar Column operated from Galanai and the Nowshera Column from Dand.

On September 5, 1933, the Nowshera Column moved up to Galanai and the Dand Camp was closed.

In addition to these columns and from the first days of the operations Mohmand Blockade Line troops, comprising cavalry, artillery and a detachment of armoured cars, were camped at Shabkadr, and later at Suban Kwar and operated from there as necessary.

The Columns moved out on light scale plus tentage in accordance with pre-arranged schemes and as soon as it became clear that the operations were likely to be protracted, kits to complete field service scale were sent forward.

Composition of the Mohmand Force.

Peshcol.

5/10th Baluch Regiment.
3/14th Punjab Regiment.
1/7th Rajput Regiment.
4th Mountain Battery R.A.
10th Mountain Battery R.A.
2nd Field Company, Sappers and Miners.
No. 2 Field Ambulance, and
Attached Troops.

Nowcol and Blockade Line.

1/11th Sikh Regiment.
3/11th Sikh Regiment.
3/2nd Punjab Regiment.
5/12th F.F. Regiment.
18th K.E.O. Cavalry.
2nd Mountain Battery R.A.
3rd Field Company Sappers and Miners.
58th Field Battery R.A.
No. 1 Field Ambulance, and
Attached Troops.

No British regiments were employed in the operations, and the number of British troops with the Columns was very small, as will be gauged by a reference to the health statistical tables given later in these notes.

Special Features of the Situation as regards the Prevention of Disease among the Troops.

Climatic Conditions.—First and foremost, in the initial stage of the operations the risk of a high incidence of heat stroke and heat exhaustion

owing to the exceptionally trying climatic conditions existent at the time had to be considered.

Luckily, however, it was only at the commencement of extensive troop movements that conditions of climate were especially troublesome, and considering the operations as a whole, the force had less difficulties of this nature to contend with than would have been the case in many other years.

The issue of ice for British and Indian troops at 4 pounds per man and 2 pounds per man respectively was authorized and proved of great benefit to all concerned, while in addition special issues and scales of ice were sanctioned for field ambulances, both for the patients and for the heat stroke stations organized and maintained by them as circumstances necessitated.

Although at times difficulties of road and transport rendered it impossible to get the full authorized supplies of ice through to the troops in the more forward areas, yet the arrangements by the supply authorities concerned functioned on the whole exceedingly well.

The field ambulances were supplied with improvised "thermos" boxes made at the A.D.M.S.'s suggestion from spare medical panniers each capable of holding 20 pounds of ice and twenty bottles of mineral water. Carried at two panniers per mule these were extremely useful and might well be added to units' equipment for severe hot weather conditions.

Similar but larger boxes, holding 1½ maunds of ice each, were made later in the M.E.S. workshops for camel transport.

The carriage of tentage with the troops was of inestimable advantage as regards protection from the sun, and special attention was given to ensuring that troops marched as far as was practicable during the cooler hours of the day. The total number of heat stroke and heat exhaustion cases reported during the operations was forty-four with one death.

Malaria.—Taking into consideration all the evidence available as regards meteorological conditions, it was clear early in August that the malaria season just commencing was likely to be a bad one and to approximate to that of 1929 when the disease was rife throughout the North-West Frontier Province. It was known in addition that many parts of the Gandao Valley are normally very malarious.

Under such circumstances, it was with considerable foreboding that the later stages of the operations were looked forward to, and a very high rate of sickness amongst the troops on account of this disease was envisaged.

It had been decided that no useful purpose would be served by including mosquito nets in the kit taken by the troops as there was no likelihood of their being able to use them in any adequate fashion, and consequently for prevention of malaria reliance had to be placed upon any local anti-mosquito measures practicable and the use of bamber oil, together with the issue of prophylactic quinine when the disease gave evidence of becoming very prevalent.

It was unfortunately necessary to keep certain Blockade Line troops at Shabkadr—a notoriously malarial place—for some time, but as soon as it

could be managed the authorities concerned moved them into camp at Suban Kwar, a very much more satisfactory arrangement.

From the point of view of malaria, Dand Camp was a particularly unenviable spot, situated as it was in a fork between two streams which met just below the camp, and which were overgrown with rushes and produced enormous numbers of anopheline mosquitoes including *A. stephensi* and *A. culicifacies*, both of which species are well known as malaria carriers.

Matters were much improved by the strenuous efforts made by No. 4 Sanitary Section under Captain G. F. Harrison, R.A.M.C., but nevertheless, large numbers of men became infected with malaria at this camp, and it is to be hoped that with the advent of the road to Galanai the last has been seen of Dand as a camp for troops.

Galanai Camp, situated in the broad dry Galanai plain, was not as malarious as Dand, but the Gandao Kwar, with its extensive anopheline breeding grounds, was in close proximity and furnished the camp with large numbers of mosquitoes, including the specially important carrier species mentioned above.

Anti-mosquito work on routine lines was carried out here by an anti-malaria officer detailed for the purpose who had regimental and coolie labour at his disposal when required.

Anti-mosquito work necessary at Camp Rattray on the line of communication and at Camp Katsai, five miles forward of Galanai on the way to Nahakki, was the responsibility of the unit medical officers concerned, but was not required on the same scale as at Dand and Galanai.

The ordinary routine precautions for the protection of troops against the bites of mosquitoes were made the subject of standing orders in each column, and comprised the use of bamber oil, the opening up of tents each day and exposure of the interiors to the sun, the exposure of as little of the body as possible after sundown, and so on.

In addition, as soon as it became clear that the malaria incidence was increasing rapidly the issue of prophylactic quinine to all troops was commenced. To the results of this measure a later section of these notes is devoted.

It may well be mentioned here that the lack of mosquito nets of suitable pattern for use in the special circumstances and terrain of frontier warfare is a great handicap to the adequate protection from malaria of troops employed in such operations, and the problem of the provision of nets of such a pattern is one requiring early solution.

Bowel Diseases—Cholera, Enteric, Dysentery and Diarrhœa.—Cholera was, as already indicated, prevalent in the Mohmand expedition of 1908, and also caused considerable anxiety in the Afghan War of 1919 on both the Kohat and Khyber lines, and these and other campaigns had pointed the moral that the origin of an outbreak of this disease is likely to be found in the heterogeneous mass of camp followers, coolies and the like accompanying the force rather than in the troops.

As regards the operations, there was increased risk of cholera occurring owing to the large numbers of coolies necessarily employed by the engineer authorities in the making of the road from Pirkala to Galanai and beyond.

These men were drawn largely from the local tribes, had no knowledge whatever of the most elementary principles of sanitation, and were wild and undisciplined.

They ultimately totalled some 4,500, and for much of the time were distributed along the comparatively short length of road (seven miles) between Karappa and Dand.

The serious possibilities of the situation were realized early and the generous co-operation of the M.E.S. authorities with the A.D.M.S., Colonel E. W. C. Bradfield, C.I.E., O.B.E., V.H.S., I.M.S., ensured that a policy of concentration of the labour referred to in suitably situated coolie camps away from the troops was at once adopted, while in addition a medical staff of 1 medical officer, 3 sub-assistant surgeons, and 4 nursing orderlies I.H.C. was made available for medical and sanitary supervision of the camps.

Anti-cholera inoculation of all troops was carried out as soon as possible, and special attention was given to the safeguarding of the water supplies on the line of communication and in the forward areas.

The inoculation of some 8,000 troops with a minimum of curtailment of the activities of the force was much assisted by the issue of inoculation outfits designed for the occasion at the suggestion of the A.D.M.S. Details of the outfit are given in an Appendix.

These measures, coupled with the very effective work performed by No. 4 Sanitary Section, reduced the risk of an outbreak of cholera and other diseases of the nature referred to above to a minimum, both among the coolies and among the troops and followers.

Sanitary Section.

The size of the force employed, the season of the year in which the operations were taken, and other considerations already detailed, indicated the urgent necessity for the early mobilization of a sanitary section, and No. 4 Sanitary Section, under Captain G. F. Harrison, R.A.M.C., was finally mobilized on August 5 and proceeded to Dand Camp on August 6.

By this date Dand Camp, at M.T. roadhead, was already congested with troops and followers, transport, supplies, coolies, etc., and was rapidly becoming most insanitary. On this account it was necessary for the main activities of the sanitary section to be devoted to this area, which from the point of view of the health of the troops was the chief danger spot.

Detachments of the section worked also at Suban Kwar, Galanai, Katsai and elsewhere as necessary. On the closing of Dand Camp at the end of August the unit moved up to Galanai.

The early stages of the Khajuri Plain operations showed what a dangerous state of affairs can rapidly develop at road-head with the

continuous inpouring of units and detachments of troops, undisciplined and untrained coolie labour, and of hordes of animal transport, and had demonstrated the urgency of the mobilization of a sanitary section at the very beginning of any frontier campaign.

The necessity of this course was again amply demonstrated by the Mohmand Operations, and there is no doubt that arrangements should exist whereby sanitary sections as required can be mobilized and sent up with or very shortly behind the first troops to go forward.

Certain difficulties in connection with personnel and equipment, as authorized for a sanitary section (Indian Army) according to the latest scales, were met with, and recommendations for the minor alterations required were submitted, details of which it is not proposed to enter into here. Suffice it to say that, as constituted during the operations, the section surmounted its difficulties and did excellent work.

Water Supplies.

The water supply at Shabkadr and Suban Kwar was from existing shallow wells; elsewhere, at Kilagai, Dand, Galanai, Camp Rattray and Katsai, it was taken from the Gandao Kwar, and for the two last named camps had to be pumped considerable distances.

Owing to possibilities of contamination of the water above the various camp water points along the course of the Gandao Kwar by coolies, local inhabitants, etc., and owing to the special risk of cholera, strict attention was paid to the protection of water supplies and chlorination was practised throughout.

At times, in addition, particularly after spates, sedimentation and precipitation were necessary, the latter being effected by alumino-ferric of which ten to fifteen grains per gallon were used.

Large canvas storage tanks, replaced to some extent later by metal tanks, were employed at water points, and the arrangements worked satisfactorily. There was, however, a tendency to neglect at times the need for clarification by siting tanks at higher and lower levels so that water clarified in an upper tank passed by gravity to a lower.

There was also a tendency not to provide sufficient delivery points at adequate distances apart, owing to which congestion in the area at busy times of the day was liable to result.

Rations.

From August 5, troops were on the field service scale of rations.

A most satisfactory feature of the supply arrangements for the operations was the sending up, from the earliest days, of dairy produce from the Government military dairy at Peshawar.

This produce was pasteurized, cooled and despatched by lorry as road conditions allowed to the various camps. Inside each milk can was a cylindrical ice-container which kept the milk at a low temperature in transit,

and on arrival at the camps the cans, together with the fresh butter and cream, were placed in insulated ice boxes, a procedure which kept the produce in very good condition in spite of the heat.

The ordinary rations were very satisfactory indeed considering all the difficulties of road and climate with which the supply authorities were faced.

Certain criticisms were levelled at the emergency ration—Shakapura biscuit for Indian troops—and it was not considered to have proved a success so far as the operations under review are concerned, owing to its rapid deterioration under unfavourable conditions and to the fact that it occupies considerable space and no suitable container exists for carrying it.

Complete and exhaustive experiments with this form of emergency ration under active service conditions were recommended by Headquarters, Peshawar District, at the conclusion of the operations.

Camp Sanitation.

Camp Sanitation.—In the early days sanitary discipline, although satisfactory in the case of most units, was in some instances not as good as it might have been, and the imperative need for strict attention to camp sanitation was not fully realized.

As instances of this may be quoted the state of affairs at Pirkala and Dand Camps where lack of sanitary discipline was responsible for the promiscuous fouling of large areas of ground and where a legacy of filth and flies was left at these camps for incoming troops and would still have been left at the former had the camp continued to be occupied.

Lack of sanitary discipline can be excused to some extent by the difficult conditions under which the troops were operating, but is none the less dangerous on that account.

The importance at the commencement of operations of satisfactory sanitation in camps on a line of march which is to become a line of communication to-morrow cannot be too heavily stressed, and it is for consideration whether any light scale of equipment should not always include latrine pans, incinerator grids, etc., so that the use of shallow trenches can be avoided, and the possibilities of promiscuous ground fouling be reduced to a minimum.

Arrangements of this nature for columns marching out at the commencement of frontier operations are, in many cases, non-existent, although it is admitted that such equipment is sent up to the troops as soon as circumstances permit.

As time went on matters improved very much, and in the case of most units there was ultimately but little to cavil at.

It is considered that the following points require special mention :—

Fly Nuisance.—This was very bad at all camps and particularly at Dand. Many factors played a part in its production, most of which have already been indicated.

Mule and camel convoys picked up enormous numbers of flies en route and did much to exacerbate the trouble at the various camps. When motor transport replaced animal convoys there was a definite diminution in the nuisance referred to.

Fly breeding was combated in the normal way by encouraging strict attention to sanitary discipline, and by the efforts of the sanitary section already alluded to.

As regards destruction of adult flies, reliance was placed on fly swatters and fly papers, both of which the Indian Red Cross Society was kind enough to supply in large numbers, also on the ordinary tanglefoot mixture. The latter did not prove very satisfactory owing to the dust and heat, and the question of an alteration in its composition for use in frontier operations in the conditions existent during the hot months requires investigation.

In addition some seventy-five roller towel flytraps (sodium arsenite) were made by the M.E.S. and issued to the sanitary section for distribution to the various camps.

These traps (non-automatic type) were found to be of great value where they could be given proper supervision by sanitary section personnel, but where such supervision had to be left to the units themselves good results were not achieved.

Captain Harrison, the Officer Commanding No. 4 Sanitary Section, suggested that the rather more expensive automatic pattern of roller towel trap should be used in future, and not the ordinary type which requires to be hand-turned at very frequent intervals especially in the hot weather.

The Holder Harriden sprayers on charge of the sanitary section were also used with the ordinary issue of fly spray (cresylic acid). Satisfactory results were obtained when the sprayers functioned as they should do, which was seldom.

Litter Disposal.—The quantities of animal litter to be dealt with were enormous especially at Dand and Galanai, and disposal by incineration was practised in the earlier period of the operations.

It was found, however, that the task was too great for really satisfactory accomplishment and tight packing in its place was tried first at Dand and later, and very much more extensively, at Galanai. This method of litter disposal proved exceedingly satisfactory, and once a start had been made, it was almost fool-proof, easily supervised and required one-fifth of the personnel that is wanted when disposal is by incineration.

A visit to the litter-disposal areas organised by Captain Harrison at Galanai would have convinced the most recalcitrant disciple of incineration of the value of tight packing, and it can truly be said that no evidence was obtainable, despite energetic search, of fly breeding due to the practice of this method, while there was ample evidence of it in the innumerable kucha incinerators in and around the various camps.

Disposal of latrine excreta and rubbish was, throughout, by incineration.

Urine and Sullage Disposal.—This was carried out by soakage pits, which on the whole worked satisfactorily.

In this connection two points of particular importance emerge.

(*a*) The crying need for empty kerosene tins, oil drums, etc. (for use in connection with soak pits), which is very certain to arise very early in any frontier operation.

This need, in the case of the operations under review, took a long time to satisfy as a sufficiency of empty tins appeared to be unobtainable.

Steps should be taken to ensure that an ample stock of such tins is made available by the supply authorities for issue immediately in future operations.

(*b*) Units did not seem to realize that a satisfactory soak pit should be covered in with rammed earth mixed with crude oil except at the inlet for urine or sullage in the centre. If the pits are not so covered in, offence is likely to occur or fly breeding result in the crevices among the stones at the top of the pit. Also the surface should slope down from the central inlet in order to avoid rain-water getting into the pit.

Sanitation of Small Detachments of British Other Ranks.—In operations of the nature of those under review, a great deal depends on the British other ranks, such as signallers, armoured car personnel, headquarters clerks, and the like, and on the preservation of their health.

The accommodation, feeding and sanitary arrangements for some of these detachments left much to be desired, and had the operations not come to a conclusion when they did it is considered extremely likely that, especially in the case of the Signals, there would have been a breakdown owing to the wornout condition of the men on account of overwork coupled with the unsatisfactory conditions, meteorological and otherwise, under which they had to live.

Such conditions were in no wise due to lack of interest or supervision by the officers commanding units concerned, but rather to the fact that establishments and equipment scales authorized for such units as district signals, armoured car companies, and the like, which are liable to be split up into small and isolated detachments at short notice and at any time, do not allow of such parties being provided with the follower personnel and sanitary and other equipment they need to ensure a satisfactory environment.

It is usually the case that the British other ranks comprising such detachments have so much to do of a technical description during frontier operations that they have no time to give to the more mundane affairs of life, and it consequently becomes necessary to provide them with more outside assistance of the nature mentioned in a greater proportion than would normally be the case with larger bodies of troops.

Health of the Troops employed in the Operations.

Statistical tables indicating hospital admission rates for officers, British other ranks, Indian other ranks, and followers separately, together with information as to the prevalence of the more important diseases, are given in Tables I to IV.

CONSOLIDATED RETURNS OF SICK AND WOUNDED. MOHMAND OPERATIONS, 1933. AUGUST 1 TO SEPTEMBER 30.

TABLE I.

Officers.

	Strength	WOUNDS		SICKNESS										
		Admissions	Ratio per 1,000	Malaria	Sandfly fever	Dysentery	Diarrhœa	Respiratory diseases	Tonsillitis	Local injuries	Other causes	Totals	Ratio per 1,000	Ratio per 1,000 per diem
NOWCOL ..	54	—	—	11	4	5	2	1	1	1	11	36	667	11
PESHCOL ..	51	—	—	5	2	—	—	—	4	—	3	14	275	5
TOTALS ..	105	—	—	16	6	5	2	1	5	1	14	50	476	8

TABLE II.

British Other Ranks.

	Strength	WOUNDS		SICKNESS												
		Admissions	Ratio per 1,000	Malaria	Sandfly fever	Dysentery	Diarrhœa	Minor septic diseases	Local injuries	Tonsillitis	Diphtheria	Respiratory diseases	Other diseases	Total	Ratio per 1,000	Ratio per 1,000 per diem
NOWCOL ..	149	—	—	66	38	2	6	11	2	3	1	1	37	167	1,120·81	18·38
PESHCOL ..	68	—	—	27	13	2	3	1	1	1	—	1	7	56	823·53	13·50
TOTALS ..	217	—	—	93	51	4	9	12	3	4	1	2	44	223	1,027·65	16·85

TABLE III.

Indian Other Ranks.

	Strength	WOUNDS		SICKNESS													Remarks
		Admissions	Ratio per 1,000	Malaria	Sandfly fever	Dysentery	Diarrhœa	Venereal disease	Respiratory diseases	Tonsillitis	Minor septic diseases	Local injuries	Other causes	Total	Ratio per 1,000	Ratio per 1,000 per diem	
NOWCOL ..	2,853	9	3·15	455	7	8	58	9	11	10	50	50	292	950	332·98	5·46	Deaths out of hospital—6 killed in action
PESHCOL ..	2,782	2	0·72	112	–	8	46	9	11	–	28	14	116	344	123·65	2·03	Deaths out of hospital—1 killed in action
TOTALS ..	5,635	11	1·95	567	7	16	104	18	22	10	78	64	408	1,294	229·64	3·76	7 killed in action

TABLE IV.

Followers.

	Strength	WOUNDS		SICKNESS											
		Admissions	Ratio per 1,000	Malaria	Sandfly fever	Dysentery	Diarrhœa	Venereal disease	Respiratory diseases	Minor septic diseases	Local injuries	Other causes	Totals	Ratio per 1,000	Ratio per 1,000 per diem
NOWCOL ..	352	1	2·84	42	3	1	2	1	4	6	2	71	132	375·00	6·10
PESHCOL ..	486	1	2·06	13	–	–	–	–	–	2	–	10	25	51·44	0·84
TOTALS ..	838	2	2·39	55	3	1	2	1	4	8	2	81	157	187·35	3·07

General Remarks.—The sickness rate under all four headings was very much heavier in Nowcol than in Peshcol, the first named column having spent a long period in Dand Camp and on the lines of communication. It should be noted also that the strengths given for Nowcol include the blockade line troops at Shabkadr and Suban Kwar.

The Peshawar Column operated under more favourable conditions as it pushed through at once to the forward area and went into camp at Galanai, a healthier situation than that of Dand and other occupied areas on the the lines of communication.

For British troops operating in temperate climates, a sick wastage of 3 per 1,000 per diem is normally allowed for.

The question of wastage to be expected on frontier operations in the summer months had been the subject of debate on many occasions prior to the operations under review, and it had been considered that, depending on the malaria probabilities of the season, the following rates might be expected :—

British troops	7 to 10 per 1,000 per diem.
Indian troops	5 to 9 per 1,000 per diem.

Actually, the figures were as follows :—

Officers	8·00	per 1,000 per diem.
B.O.Rs.	16·85	
I.O.Rs.	3·76	
Followers	3·07	

In considering these figures, however, the following points should be borne in mind : (*a*) Malaria was the chief cause of admissions to field ambulances ; (*b*) the operations came to a conclusion at the end of September before the malaria incidence had risen to its peak ; (*c*) the numbers of British other ranks were small, as no British battalions took part in the operations. Also the conditions under which they served were not altogether satisfactory (*vide* remarks at page 83) ; (*d*) quinine prophylaxis undoubtedly played an important part in reducing hospital admissions to a minimum *during the operations* (but *vide* special remarks on this subject at page 87 *et seq.*)

It is difficult, after weighing the various factors in the situation, to come to a conclusion other than that had the operations been continued throughout October the sickness rate for Indian other ranks and followers would have reached the higher estimates of probabilities given above, while those for British troops would have considerably exceeded them.

Bowel Diseases.—The main focus of infection was likely to be the local labour employed in the shape of coolies and other untrained and undisciplined personnel. Actually, a comparative absence of disease of this nature in the coolies, coupled with the sanitary control under which they were placed, together with strenuous anti-fly measures, and special attention to water purification, resulted in a very small incidence of this

group of diseases among the troops, and there was a complete absence of cholera.

Effects of Heat.—As already indicated, climatic conditions were on the whole less severe than normal and this fact coupled with the practice of the usual methods of prevention and the carrying of tentage, resulted in this group of diseases playing a very minor part as a producer of inefficiency. The total admissions were forty-four only, including one death out of hospital.

Malaria.—This disease, as was to be expected, caused numerous admissions to field ambulances, as follows:—

Nowcol.				
Officers ..	.. 11 in a total of	36 admissions, i.e.	31 per cent.
B.O.Rs...	.. 66 in a total of	167 admissions, i.e.	40 per cent.
I.O.Rs. ..	.. 455 in a total of	950 admissions, i.e.	48 per cent.
Followers	.. 42 in a total of	132 admissions, i.e.	32 per cent.
Total ..	.. 574	1,285	45 per cent.
Peschol.			
Officers ..	.. 5 in a total of	14 admissions, i.e.	36 per cent.
B.O.Rs. ..	.. 27 in a total of	56 admissions, i.e.	48 per cent.
I.O.Rs. ..	.. 112 in a total of	344 admissions, i.e.	33 per cent.
Followers	.. 13 in a total of	25 admissions, i.e.	52 per cent.
Total ..	.. 157	439	36 per cent.

The figures given above afford remarkable evidence of the ravages malaria may cause in troops who have to operate on the frontier in the malaria season, and indicate how essential it is at such times to do all that is possible to ensure that camps are sited in as favourable situations from the medical point of view as strategic conditions will allow. It is a pity that such conditions necessitated the selection of Dand as a site for a large camp at road-head as, without doubt, a proportion of the malaria and other diseases contracted there by the troops of the Nowshera Column could have been avoided had the camp been established further back in an area where there was more space and conditions as regards mosquito breeding were not so favourable.

Owing to the malaria probabilities of the autumn months, the impracticability of using mosquito nets and the fact that the ordinary routine anti-mosquito measures were, perforce, somewhat limited in extent, it was decided to reinforce the normal preventive methods by the issue of prophylactic quinine, and this was commenced in Nowcol on September 1 and Peshcol on September 6.

From these dates onwards up to the conclusion of the operations ten grains of quinine bihydrochloride in tablet form were administered daily in the evening to all troops except on Sundays.

In the absence of controls of any description it is useless to theorize on the admission figures for malaria and the effect thereon of prophylactic

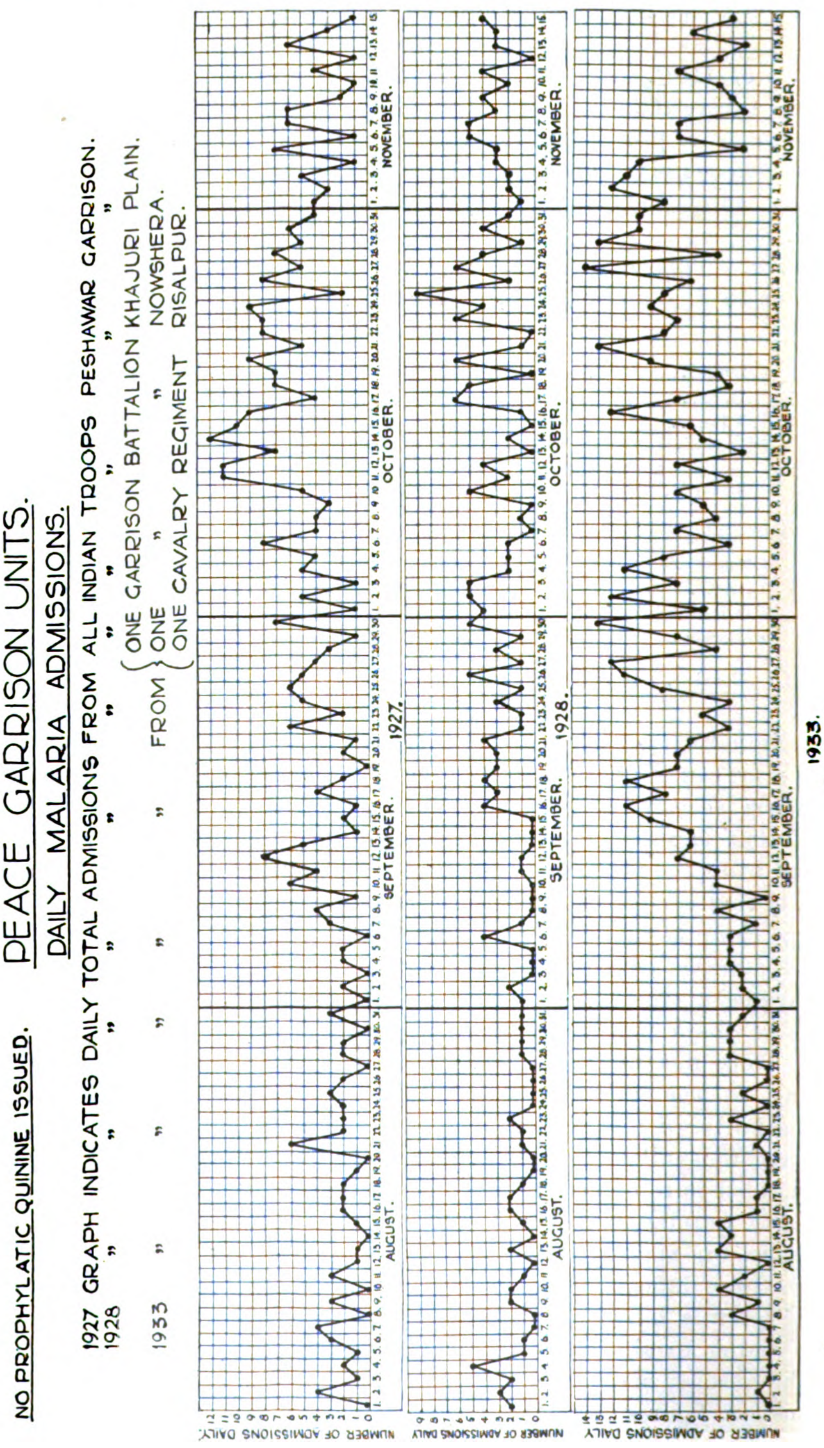

NO PROPHYLATIC QUININE ISSUED.
PEACE GARRISON UNITS.
DAILY MALARIA ADMISSIONS.
1927 GRAPH INDICATES DAILY TOTAL ADMISSIONS FROM ALL INDIAN TROOPS PESHAWAR GARRISON.
1928 " " " " " " ONE GARRISON BATTALION KHAJURI PLAIN.
1933 " " " " FROM ONE " " NOWSHERA.
ONE CAVALRY REGIMENT RISALPUR.
NUMBER OF ADMISSIONS DAILY.
AUGUST.
SEPTEMBER.
OCTOBER.
NOVEMBER.
1927.
1928.
1933.

CHART I.

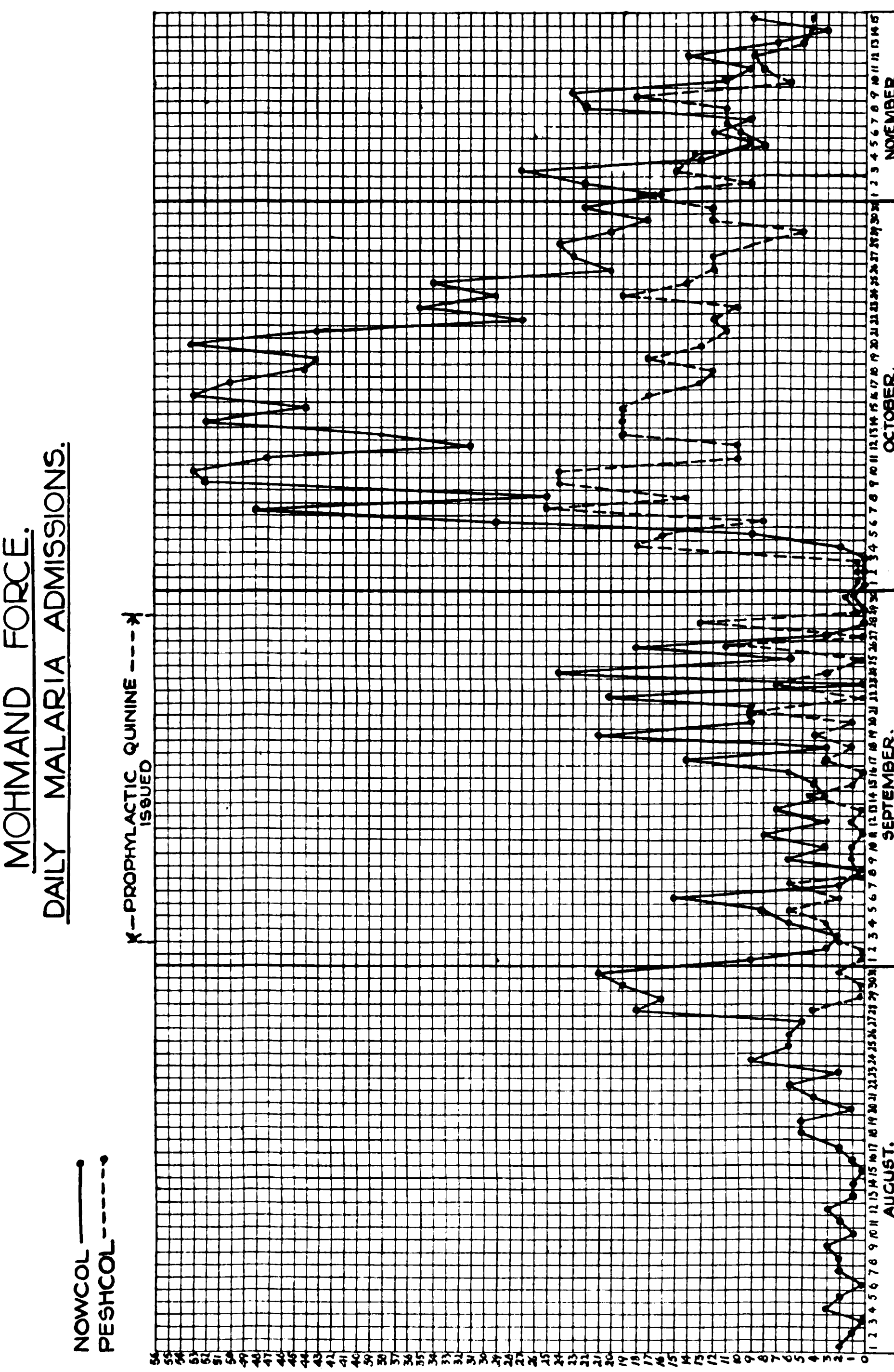

MOHMAND FORCE.
DAILY MALARIA ADMISSIONS.
NOWCOL
PESHCOL
PROPHYLACTIC QUININE ISSUED
AUGUST.
SEPTEMBER.
OCTOBER.
NOVEMBER.

Chart II.

7

quinine so far as estimating the actual total reduction in malaria incidence effected by this measure is concerned and it is proposed to waste no time in discussing this aspect of the question.

From the point of view of the efficacy of this measure of protection in keeping troops on their feet over a more or less limited period during active operations, it is interesting to study Charts I and II.

The first chart deals with the daily admissions for malaria, August to November inclusive, in : (*a*) Indian troops of the Peshawar garrison, 1927; (*b*) Indian troops of the Peshawar garrison, 1928 ; (*c*) three Indian units—one on Khajuri Plain, one in Nowshera and one in Risalpur in 1933 (i.e. units which remained in peace stations the whole summer). Quinine was not given to these troops at all.

The second chart shows daily admission for malaria in Peshcol and Nowcol during the two months of the operations and for one and a half months after their conclusion (larger units only), prophylactic quinine in this case being given approximately throughout September.

A comparison of the two charts gives an indication of the normal rise in malaria incidence in October in peace stations, when quinine prophylaxis is not in the picture, compared with the increase that occurred in the Mohmand Force when the drug was given during September and then dropped.

It will be agreed that such normal factors as the October rise, the collecting of cases in units at the end of September and beginning of October when the columns were on the march home, and other minor factors, can hardly be held accountable for the large and sustained increase that occurred when the issue of quinine ceased.

The evidence of the charts is also much in favour of the fact that this measure afforded valuable assistance as regards keeping many of the troops on duty for the latter half of the operations who under other circumstances would have been in hospital.

Conclusion.

This " little frontier war " took place at the most unpropitious time of the year possible and is of special interest from the point of view of military hygiene, both on this account and in view of the fact that so much outside and undisciplined labour was employed in the comparatively small area of the operations.

Considering all the circumstances, the comparatively good health of the troops, except as regards malaria, and the very small incidence of the bowel disease in the force, says a great deal for the sanitary discipline of the troops themselves and is evidence of the cordial co-operation given the medical authorities by the formation headquarters and officers commanding units concerned.

APPENDIX.

List of Contents of the Inoculation Outfit.

Syringe in Spirit	1 (one)
Spirits, Methylated, bottle	1 (one)
Distilled water, bottle	1 (one)
Needles in Spirit	8 (eight)
Gallipot	1 (one)
Forceps, pairs	1 (one)
Cotton Wool, 20 oz. packets	4 (four)
Lamps, Spirit, improvised	1 (one)
Matches, box of	1 (one)

Acknowledgment.

The author's thanks are due to Colonel E. W. C. Bradfield, C.I.E., O.B.E., V.H.S., F.R.C.S., I.M.S., A.D.M.S., Peshawar District, for his encouragement, interest and helpful advice, and for giving his permission for these notes to be forwarded for publication.

THE EFFECT OF COOKING ON THE *CYSTICERCUS CELLULOSÆ*.

FROM THE HYGIENE DEPARTMENT, ROYAL ARMY MEDICAL COLLEGE, LONDON.

INTRODUCTION.

WITH the object of determining whether cooking, as ordinarily practised in the British Army, renders pork infested with the *Cysticercus cellulosæ* safe for human consumption, a series of experiments was recently carried out in the Hygiene Department of the Royal Army Medical College.

Since fresh specimens of measly pork were unobtainable, the plan adopted was to cook, in the manner usual in the Army, four of the common forms of pork, and at the same time to record by means of a thermocouple the temperature reached in the interior of each article of food at intervals during the cooking, the final step being to compare these temperatures with a temperature which could be accepted as the thermal death point of the Cysticercus.

Unfortunately there seems to be some difference of opinion as to what this temperature is.

Ostertag [1] states that a temperature of 49° C. (120·2° F.) kills the *C. cellulosæ,* although he does not state on what ground he bases his statement.

Chandler [2] considers a temperature of 52·8° C. (127° F.) as representing its thermal death point, but he also omits to state on what grounds this conclusion is arrived at.

It is stated by Kenwood and Kerr [3] that there is "good ground for believing that exposure for some minutes to a temperature above 150° F. (i.e., 65·5° C.) destroys" the *C. cellulosæ,* but these authors also omit to mention what these grounds are.

Even if the unwarrantable assumption is made that the Cysticercus can survive exposure to a temperature at which body protoplasm is coagulated (56° C. or 133° F.), it appears highly improbable that even momentary exposure to a temperature of 62° C. (143·6° F.), at which point egg albumin is coagulated, will fail to kill it.

The articles of food investigated included pork sausages, ham, pork chops and leg of pork. To ensure that only customary methods of cooking were followed, the experiments were all carried out in the presence of the cook to No. 18 Company, R.A.M.C., and the methods recommended in the Manual of Military Cooking and Dietary, 1933, for cooking each particular article were adhered to. To obviate as far as possible any error due to the thermocouple, the instrument was carefully calibrated before each experiment.

A.—Pork Sausages.

The sausages were ordinary short, thick pork sausages, weighing approximately 2·7 ounces each, and were purchased from a local butcher. There are three common methods of cooking sausages: Dry frying, deep frying and baking in an oven. The sausages were therefore divided into three groups, each group consisting of three sausages.

Dry Frying (Three Sausages).—A small slit was made in the skin at one end of each sausage and a central passage made longitudinally down the interior of the sausage with a small scalpel; the terminal of the thermocouple was then inserted into this passage and the skin at the opening then bound tightly with thin wire round the thermocouple to prevent direct access of fat to it. The final position of the terminal was approximately equidistant from each pole of the sausage and from its circumference.

Each sausage was then fried in a layer of fat, ¼ inch deep, in an ordinary frying pan over a coal fire in a cooking range.

The skins of two of the sausages were, as is customary in this form of cooking, pricked with a fork before cooking, while the skin of the other was not so pricked. The sausage which was not pricked burst during cooking. The sausages were removed from the frying pan when the cook considered them to be "done" and were then placed on cold china plates.

As will be seen from Graph 1, the Ostertag, Chandler, body protoplasm and egg albumin temperatures were reached by all three sausages before the cook considered the sausages "done." In the case of sausage No. 2, the Kenwood and Kerr temperature was also reached, while sausage No. 3 attained a temperature above the blood serum coagulation point.

It is interesting to note that in all three sausages the temperature continued to rise for some minutes after removal from the pan; sausage No. 1 to 68·5° C. (155·3° F.), No. 2 to 80° C. (176° F.), and No. 3 to 84° C (183·2° F.), all reached within three minutes of cessation of cooking.

This phenomenon was noticed in all our cooking experiments.

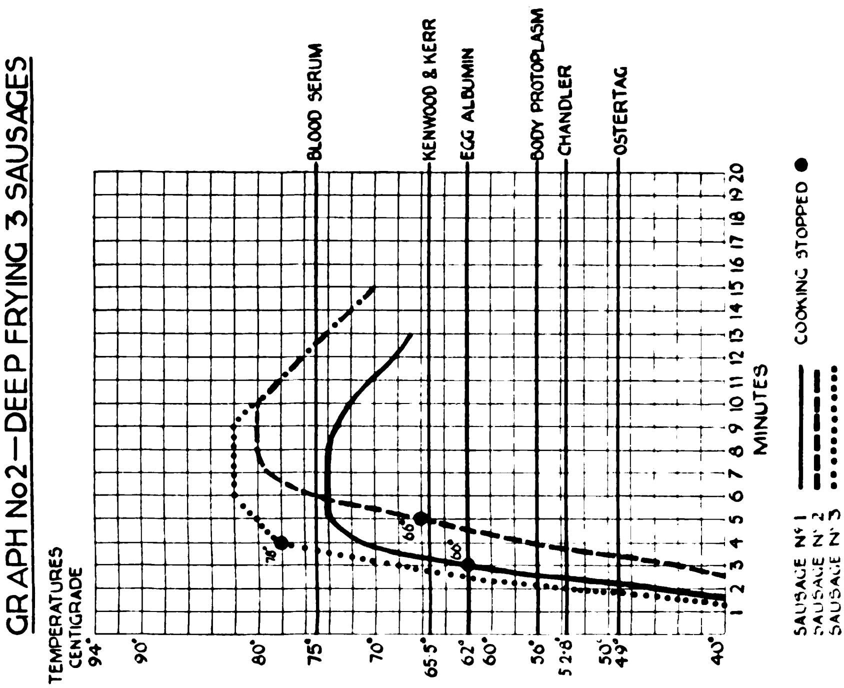
Deep Frying (Three Sausages).—The thermocouple terminal was inserted and fixed in each of these three sausages in the same way as in the previous experiment.

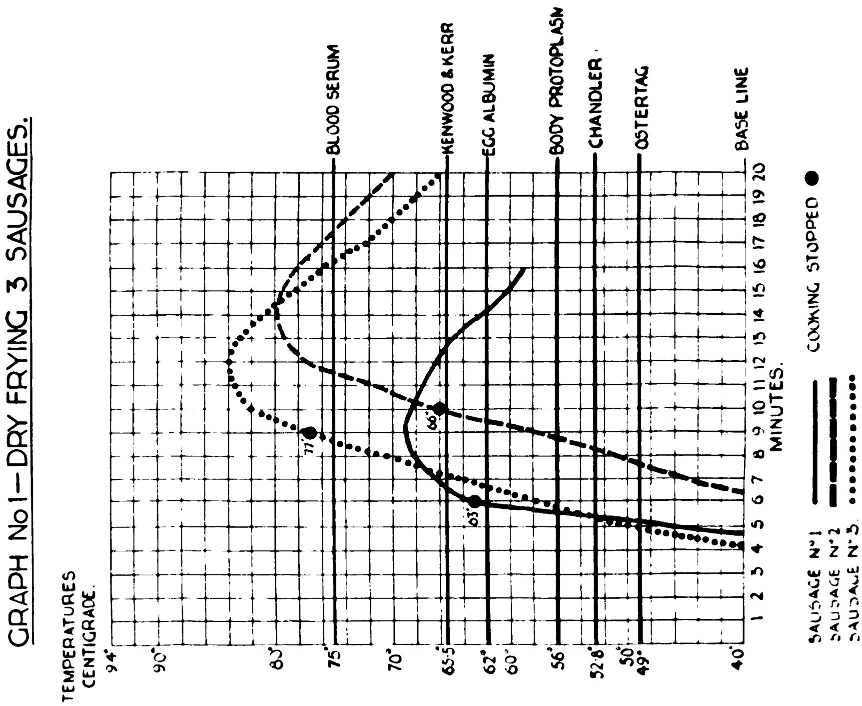
The skin having been pierced, each sausage was cooked by plunging it into boiling fat (temperature 180° C. or 354° F.) in a baking dish and treated in the manner usual in this style of cooking.

The sausages were removed from the boiling fat when the cook considered them to be "done," and placed on a cold china plate.

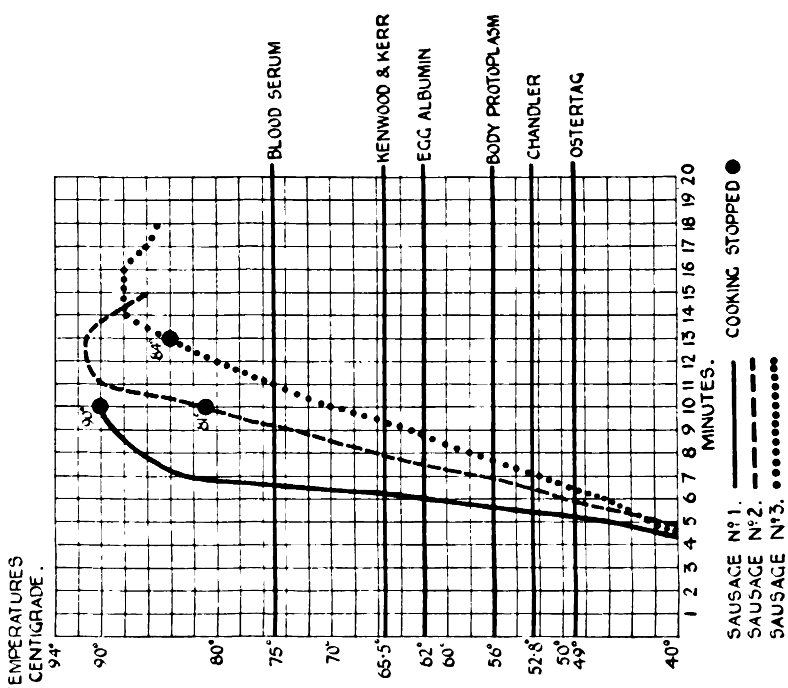
As will be seen from Graph 2, the Ostertag, Chandler, body protoplasm and egg albumin temperatures were reached by all three sausages before the cook considered them "done."

In the case of sausage No. 2 the Kenwood Kerr temperature was also reached, while sausage No. 3 attained a temperature above the blood coagulation point. The highest temperatures reached after the cessation

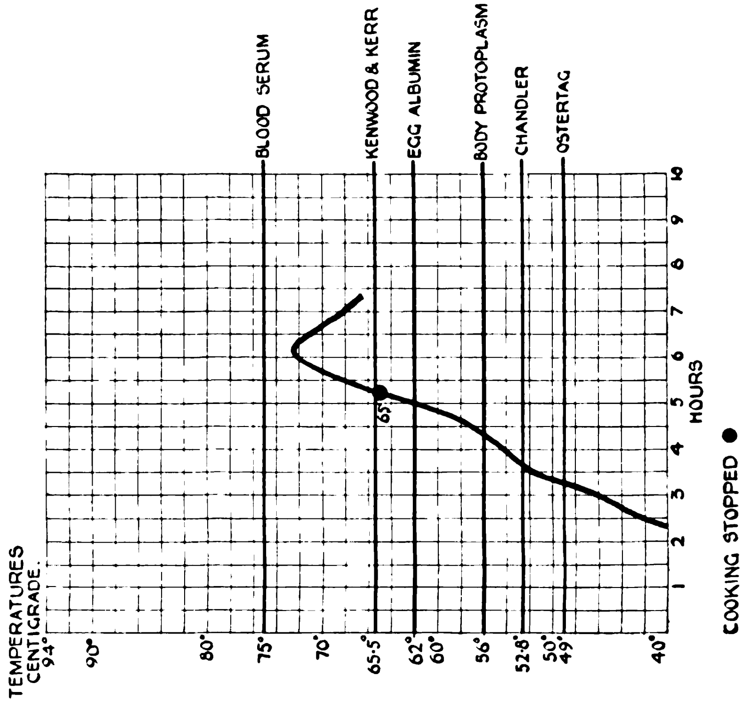

GRAPH No2—DEEP FRYING 3 SAUSAGES
TEMPERATURES CENTIGRADE
94° 90° 80° 75° 70° 65·5° 62° 60° 56° 52·8° 50° 49° 40°
BLOOD SERUM
KENWOOD & KERR
EGG ALBUMIN
BODY PROTOPLASM
CHANDLER
OSTERTAG
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
MINUTES
78° 66° 60°
SAUSAGE Nº 1
SAUSAGE Nº 2
SAUSAGE Nº 3
COOKING STOPPED


GRAPH No1—DRY FRYING 3 SAUSAGES.
TEMPERATURES CENTIGRADE.
94° 90° 83° 75° 70° 65·5 62° 60° 56° 52·8° 50° 49° 40°
BLOOD SERUM
KENWOOD & KERR
EGG ALBUMIN
BODY PROTOPLASM
CHANDLER
OSTERTAG
BASE LINE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
MINUTES.
77° 66° 63°
SAUSAGE Nº 1
SAUSAGE Nº 2
SAUSAGE Nº 3
COOKING STOPPED

GRAPH No3 — BAKING 3 SAUSAGES.



GRAPH No4 — BOILING A HAM.



of cooking were: Sausage No. 1, 74° C. (165·2° F.); No. 2, 80° C. (176° F.); No. 3, 82° C. (179·6 F.), all attained within three minutes of removal from the pan.

Baking (*Three Sausages*).—The thermocouple terminal was inserted and fixed in each of these three sausages in the same way as in the previous experiments.

The skin having been pierced, each sausage was baked in a baking dish in an oven, the procedure usual in this method of cooking sausages being followed throughout.

The sausages were removed from the oven when the cook considered them to be "done," and were placed on a cold china plate.

The temperature of the oven was recorded throughout the experiment by means of a pyrometer, and was as shown in Table I below:—

TABLE I.

Time	Temperature of Oven					
	No. 1.		No. 2.		No. 3.	
	C.	F.	C.	F.	C.	F.
Zero	128°	262·4°	128°	262·4°	132°	269·6°
2 minutes ..	132°	269·6°	132°	269·6°	130°	266°
4 minutes ..	136°	276·8°	132°	269·6°	132°	269·6°
8 minutes ..	140°	284°	134°	273·2°	132°	269·6°
10 minutes ..	144°	291·2°	136°	276·8°	136°	276·8°
12 minutes ..	—	—	—	—	138°	280·4°
14 minutes ..	—	—	—	—	138°	280·4°

As will be seen from Graph 3, the Ostertag, Chandler, body protoplasm, egg albumin, Kenwood and Kerr, and blood-serum temperatures were reached with all sausages before the cook considered them "done." The highest temperatures reached after cessation of cooking were: Sausage No. 1, 95° C. (203° F.); No. 2, 91° C. (195·8° F.); No. 3, 88° C. (190·4° F.); all attained within 1 minute after removal from the baking dish.

B.—HAM.

The ham, which was purchased from the N.A.A.F.I., weighed 14 pounds 5 ounces, and contained an average amount of fat. A skewer was thrust into the interior of the thickest portion of the ham to a depth of 2½ inches (that is, it penetrated as nearly as possible to the centre of the ham), withdrawn and the terminal of the thermocouple inserted to the bottom of the opening thus made. The opening was then sealed with plaster of Paris to prevent direct access of hot water to the terminal.

Mrs. Beeton's Cookery Book recommends boiling a ham by immersing it in boiling water for ten minutes, then cooling the water by the addition of a pint of cold water, bringing to the "simmer" and simmering for twenty minutes per pound weight (i.e. five hours simmering in the case of a 15-pound ham).

The Manual of Military Cooking and Dietary recommends boiling a ham by immersing it in boiling water, boiling briskly for ten minutes and then allowing it to simmer for the remainder of the cooking. This Manual states that twenty minutes per pound should be allotted to the whole process (i.e. for a 15-pound ham five hours from time of immersing in the boiling water until removal cooked). The two methods are thus almost identical, Mrs. Beeton cooking for a slightly longer time than is recommended in the Manual. The method advised in the Manual was followed.

The temperature of the water on immersion of the ham was 100° C. (212° F.), at which temperature it was kept for ten minutes, and thereafter allowed to simmer (average temperature 90° C. (194° F.) to 95° C. (203° F.)). According to the Manual of Military Cooking and Dietary the ham should have been cooked in four and three-quarter hours from first being placed in the boiling water, but the cook did not consider it properly cooked until five and one-third hours had elapsed from this time. The ham was accordingly cooked for five and one-third hours in all. The saucepan was then removed from the fire, but the ham, as is customary, was not removed from the water for another two hours.

As will be seen from Graph 4, the Ostertag, Chandler, body protoplasm and egg albumin temperatures were reached within the cooking time. The highest temperature reached after cessation of cooking was 72·5° C. (162·5° F.), which was attained one hour after removal of the saucepan from the fire.

C.—Roast Pork.

A leg of fresh pork weighing 11 pounds 2 ounces was purchased from the N.A.A.F.I. A passage was made into the thickest part of the leg with a skewer to a depth of 2½ inches, reaching as nearly as possible to the centre. Into the bottom of this passage the terminal of the thermocouple was inserted, and the opening then sealed with plaster of Paris as in the previous experiment with the object of preventing direct access of hot basting fat to the terminal.

The joint was then cooked by the method usually known as "roasting," but more correctly described as "baking," in a coal-fired oven.

Mrs. Beeton's Cookery Book recommends that in this method twenty minutes per pound should be allowed, plus an extra twenty minutes added to the total time as calculated on the poundage, the joint being placed in a "hot" oven. For the joint in question the time allowed by Mrs. Beeton works out at four hours.

The Manual of Military Cooking and Dietary advises that the oven should be "thoroughly hot" before placing the joint inside, but lays down no time as a guide to the length of cooking. The cook under whose supervision the cooking was carried out gave as his opinion that three to three and a half hours would be necessary to cook the joint.

Actually, as the result of opening the meat with a fork and inspecting the interior, the cook did not consider the joint "done" until four hours

seven and a quarter minutes had elapsed since first placing it in the oven. The temperature of the oven was recorded throughout the experiment by a pyrometer and was as shown in the table below:—

TABLE II.

Time		Temperature of Oven	
		Centigrade	Fahrenheit
Zero ..	..	50°	122°
1 hour ..	..	136°	276·8°
2 hours ..	..	108°	226·4°
3 hours ..	..	116°	240·8°
4 hours ..	..	144°	291·2°

As will be seen from Graph No. 5, the Ostertag, Chandler, body protoplasm, egg albumin, Kenwood and Kerr, and blood serum temperatures were all reached within the cooking time. The highest temperatures reached by the joint after cessation of cooking was 81° C. (177·8° F.), and was attained within half an hour of removal from the oven.

D.—PORK CHOPS.

Three pork chops of an average thickness of one inch were fried in a frying pan in about ¼ inch of fat. In chops No. 1 and 2 the thermocouple terminal was inserted into the centre of the lean part of the chop, and in chop No. 3 into the middle of the fat.

When the cook considered that the chops were "done," they were removed from the pan and placed on a cold china plate.

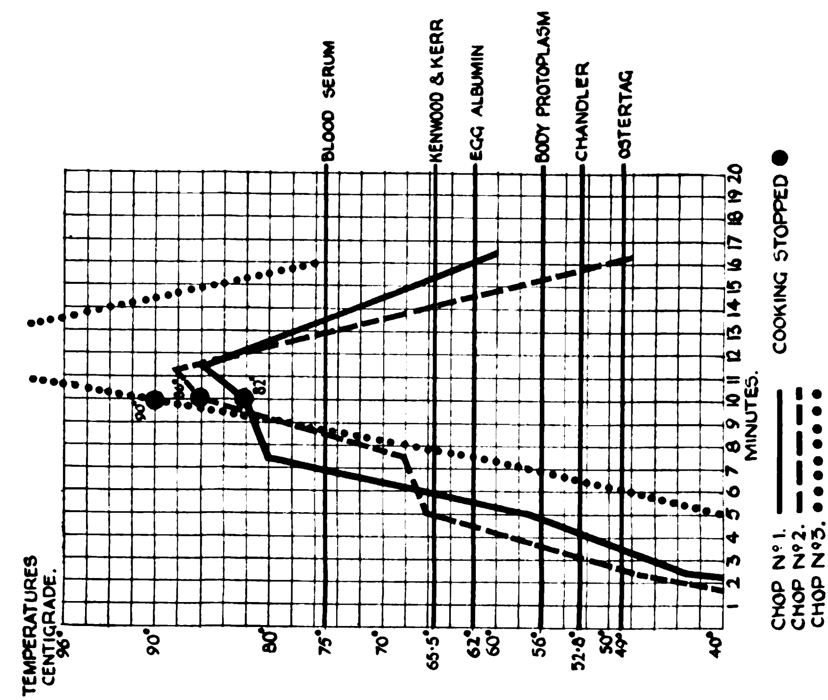
As will be seen from Graph No. 6, the Ostertag, Chandler, body protoplasm, egg albumin, Kenwood and Kerr, and blood serum temperatures were all reached well within the cooking time. The highest temperatures reached after cessation of cooking were: No. 1, 86° C. (186·8° F.); No. 2, 88° C. (190·4° F.); No. 3, 98° C. (208·4° F.) (not shown on graph), and were attained within two minutes after removal from the pan.

CONCLUSIONS.

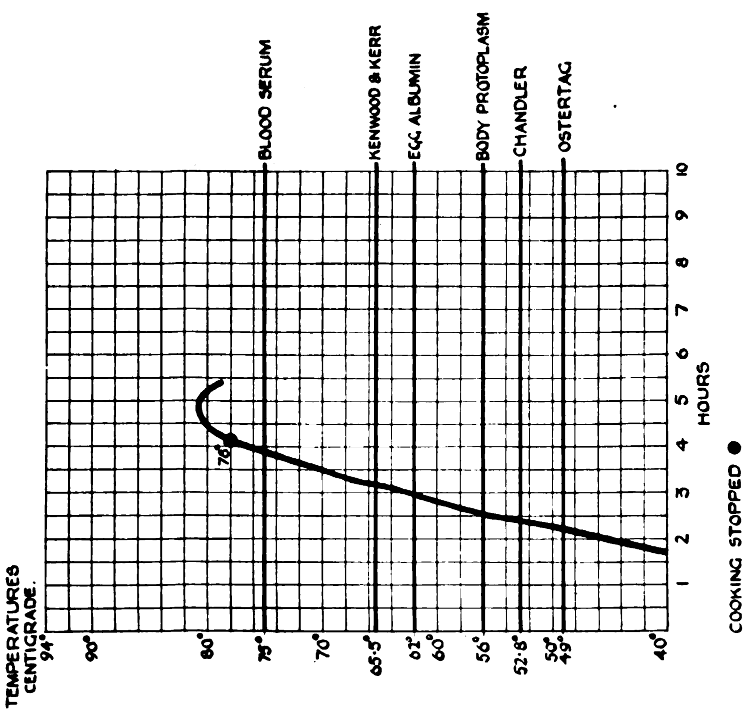
If Ostertag and Chandler are correct in their estimation of the temperatures necessary to kill the *C. cellulosæ* (49° C. and 52·8° C. respectively), it appears certain that cooking as ordinarily practised in the Army renders cysticercus-infested pork sausages, ham, leg of pork and pork chops safe for human consumption, since these temperatures were reached *well* within the normal cooking periods for all these articles.

If, however, Ostertag and Chandler are both wrong and Kenwood and Kerr are correct in their estimation of the lethal temperature (65·5° C.), it also appears that cooking in the usual Army manner will render these articles of food safe for men to eat since this temperature (65·5° C.) was reached within the cooking periods for all articles, except sausage No. 1, which burst.

GRAPH No.6 — FRYING 3 PORK CHOPS.



GRAPH No 5. ROASTING A LEG OF PORK.



It should be pointed out that this sausage was not cooked in the ordinary way since its skin was not pricked, a fact which led to its bursting.

It seems to us, however, to be hardly feasible that the *C. cellulosæ* could survive after body protoplasm had been coagulated (56° C.): and certainly not after egg albumin had coagulated (62° C.).

If this view is correct, there appears to be no doubt that *ordinary* Army cooking kills *C. cellulosæ* in all forms of pork.

The forms of cooking with the largest margin of safety appears to be baking, roasting and frying (in the case of chops), since in all these a temperature above blood serum coagulation point (75° C.) was reached within the cooking time.

It should be mentioned that when cooked by us (and it should be emphasized that only standard Army cooking methods were adopted) all the articles of pork would have been described by the ordinary man in the street as "well done" as opposed to "underdone," and presented no sign whatever of "rareness."

The soldier's well-known preference for over-cooked food, so often adversely commented upon by civilian cooks, therefore appears to be a wise, though doubtless unpremeditated, safeguard against cysticercosis when serving in the tropics.

We are indebted to the Officer Commanding No. 18 Company, R.A.M.C., for permission to use the Company kitchen and for the valuable assistance of the Company cook while these experiments were being carried out.

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SOME SUGGESTED IMPROVEMENTS TO CAMP STRUCTURES AND A FEW PRACTICAL POINTS ABOUT CAMPS ON A MARCH.

By Major E. W. WADE, D.S.O.,
Royal Army Medical Corps.

I have written this article in the hope that it will be of assistance to medical officers going to camp for the first time, as it illustrates certain practical points which I have found out for myself and which if attended to at once save an enormous amount of trouble in the end.

We will consider that a battalion is going to do a ten days' march to a final camp where it is going to remain for a period of weeks or months, and that Lieutenant "A," R.A.M.C., has been detailed three days before the commencement of the march to act as medical officer to the battalion.

(A) Duties in Connection with the Battalion.

(1) He should immediately get in touch, personally, with the O.C., and ascertain the route, camp sites and final destination. If possible he should visit these beforehand with the O.C. and lay out the sites in conjunction with him.

(2) He should consult the adjutant as to numbers of personnel trained in water duties and sanitary duties and obtain their Army numbers, names and companies. If his water and sanitary personnel are untrained he should at once commence intensive training. He should also ascertain from the adjutant what receptacles are being provided for water sterilization, e.g. water carts, pakhals, metal tanks, etc.

He should arrange with him (the adjutant) (*a*) To publish orders (which the M.O. should draft) on the duties of the water and sanitary personnel; and (*b*) to issue instructions for all water duty personnel and half the sanitary personnel to proceed with the advance party each day and for the remainder of the sanitary personnel to march with the rear party. This ensures that purified water will be ready in each camp before the battalion arrives, and that the previous camp site will be left clean, e.g. all latrines, refuse pits, etc., filled in, and the whole area cleaned up. If a midday halt is being made two sanitary men should march with the main body to provide shallow trench latrines.

(3) He should also consult the quartermaster as to the numbers of R.E. structures, latrine buckets, night urine buckets, cooks' tables, refuse receptacles, meat safes, general and hospital tentage, tables, forms, etc., being provided in the final camp.

(4) He should see the M.I. room corporal and ascertain from him

whether he has a 2nd Class Certificate of Education (K.R., 1928, para. 1345), and how long he has been employed on this kind of work.

He should check the medical equipment he is taking to camp, not forgetting stretchers, Thomas's splints, blankets, sterilizer, stove, methylated spirit, lamps and any extra equipment required for his hospital, such as urine bottles, beds, blankets, hospital latrine, etc.

He should also take all the medical history sheets with him and his two water sterilization cases and see that he has a supply of freshly prepared starch cadmium iodide indicator and plenty of clarifying and water sterilizing powders.

(B) Duties in Connection with the March.

He should ensure that his medical equipment is easily accessible during the march in case of necessity and make sure that an ambulance is accompanying the unit on the march and for the period at the final camp and that emergency equipment has been included. He should catch up each day with the advance party after the midday halt in order to supervise water purification, and to see that the camp sites are laid out as previously decided upon. For this purpose it is essential that he should take his car or be provided with a horse. The M.I. corporal should ride in the ambulance and follow behind the main body.

No man should be allowed to fall out without a written permission from his Platoon Commander. The man should then wait on the left-hand side of the road and be picked up by the ambulance when it comes along.

Most, if not all, units are very strict about permitting smoking whilst marching, and drinking from the water bottle is not allowed except when the O.C. gives the order.

Sick parade should be arranged at such an hour in the morning as will enable all the sick to have been disposed of before the march begins.

(C) R.E. Structures to be Provided in the Final Camp.

The scale of issue and type of appliance is shown in "Engineer Services for Territorial Camps, Types and Scales of Camp Structures for Temporary Camps, Appendix 'A,' 1930." It has been found in practice that many of these can be improved upon as follows :—

(*a*) *Meat Safes.*—These should be of the dimensions shown in the sketch (fig. 1). They should be divided into two halves, one being provided with hooks for hanging joints up to the size of a hind- or fore-quarter of beef, and be provided with a removable metal drip tray on the floor. The other half should be provided with two or three shelves for putting small articles on, such as butter, suet, open tins of jam, marmalade, etc.

The walls should be made of perforated zinc instead of hessian canvas as they are far more easily cleaned when they become soiled and the perforations greatly improve the ventilation. As many of these meat

safes stand in the open, the roof and top half of the walls should be covered on the inside with aluminium foil on asbestos felt with half an inch air space between this and the walls of the safe. This foil costs 11d. per square yard and may reduce the temperature inside by some 21° F.

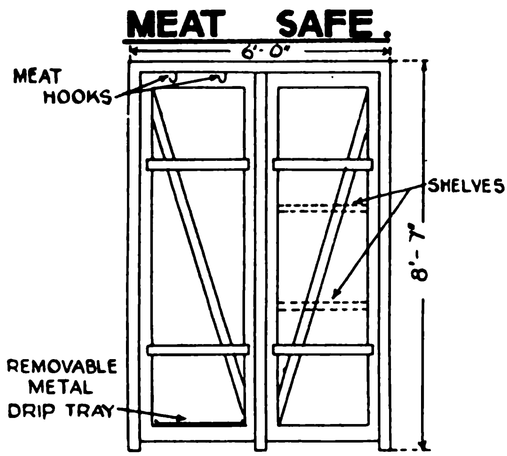

FIG. 1.

(*b*) *The washing-up benches* at the cookhouses and the *ablution benches* should be of the pattern shown in the sketches (fig. 2.)

The advantages of this type are that the ground around and underneath the bench is always dry, the water does not shoot over the trough at the lower end, the fronts of the men's trousers do not get wet, one type of

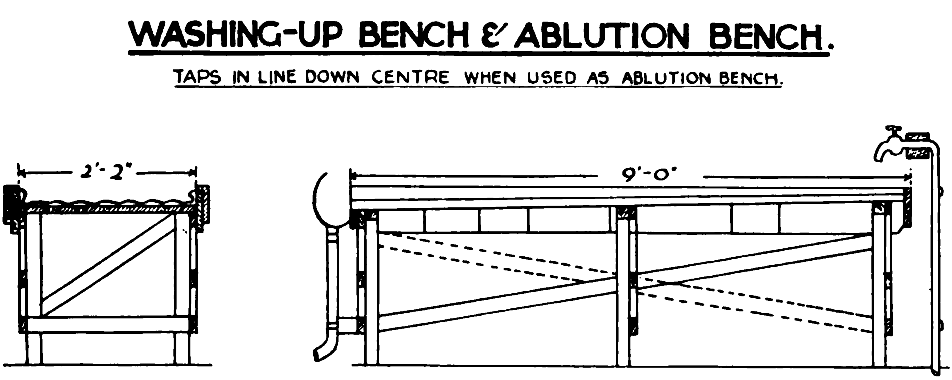

FIG. 2.

bench serves two purposes, and the top of the bench being of metal is more easily cleaned.

(*c*) *Shower Baths.*—The side walls of these baths should be eight feet from the centre in order to keep the clothes hanging on the hooks dry. They need only be made of hessian canvas instead of corrugated iron as

only a screen is required. Below the duckboards the floor should be made of corrugated iron, overlapping by one corrugation and sloping to a corrugated iron channel leading to a grease trap and soakage pit (*see* fig. 3).

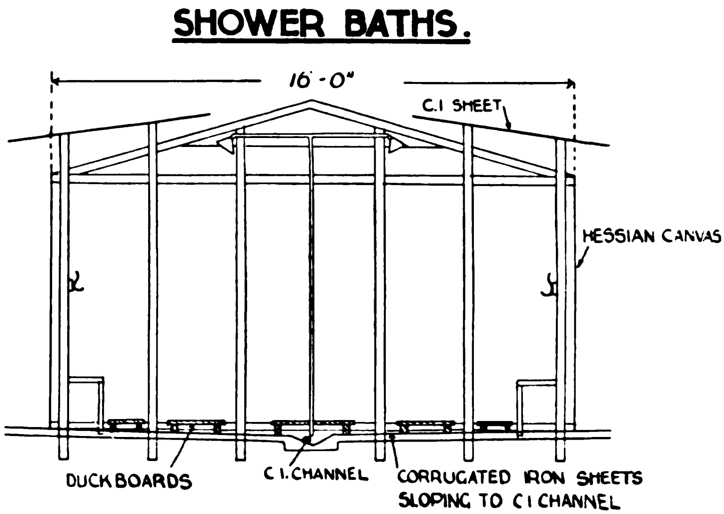

Fig. 3.

Some method of providing tepid showers is a great asset in most climates.

(*d*) *The grease traps* are the greatest source of worry in all camps. The pattern shown (fig. 4), the Coke Trap, is considered the most effective

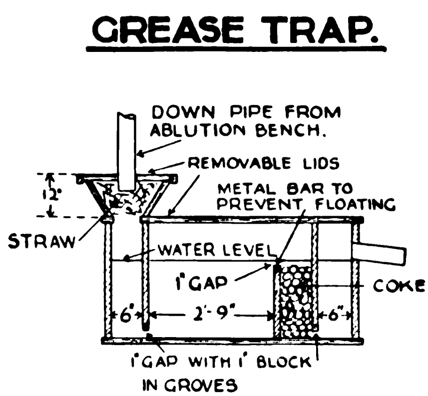

Fig. 4.

of all, if constructed according to the dimensions given. If coke is not available stones or shingle may be used. *It must however be water-tight,* and if lined with zinc would be far more easily cleaned than at present.

The bottom of the first and third baffles should be 1 inch above the

bottom of the box, no more and no less. There should be a 1-inch block of wood fixed at the bottom of the grooves in which these baffles slide. The top of the second baffle should be 1 inch below the surface of the water, no more and no less.

All baffles should have a bar of iron along the upper edge to prevent them floating out of position. The second baffle must always touch the bottom of the box. The space between the second and last baffles should be filled with coke to a level with the top of the second baffle. This coke should be changed daily when the baffles are removed for cleaning. The coke which has been removed can be used as fuel in the cookhouse or bath-house.

(*e*) The most suitable type of *incinerator* is that shown in The Army Manual of Sanitation, 1926, fig. 30, yet how often one finds an open square brick incinerator provided.

A SHORT REVIEW OF THE WORK IN THE MATERNITY DIVISION OF THE LOUISE MARGARET HOSPITAL, DURING THE YEARS 1928, 1929, 1930 AND 1931.

By Lieutenant-Colonel P. C. FIELD,
Royal Army Medical Corps.

During this period 2,158 confinements were conducted. The maternal deaths were two in number, both due to eclampsia at or near term. One case occurred in a patient not booked to enter hospital for confinement and admitted *in extremis.* She died undelivered. The other case which had been under ante-natal supervision had shown no premonitory symptoms, but developed eclampsia when in labour, having only one fit, followed by coma and death.

The still-births for the period number 51 or 2·4 per cent.

Delivery by Cæsarean section was performed on twenty-eight occasions, two cases being for the second time. The mothers all did well; two children were still-born. In the first of these two cases the operation was performed in the mother's interest on account of severe antepartum hæmorrhage; in the second, on account of an acute abdominal condition due to degenerating fibroids in a woman with valvular disease of the heart. The uterus was removed at the same time and weighed 9 pounds.

The interest of the above figures lies in the fact that the Louise Margaret Hospital occupies a somewhat unique position among Maternity Hospitals in this country inasmuch as all its cases with negligible exceptions are under repeated antenatal supervision for either the duration of pregnancy, or for the more important later period in the case of those women arriving in the Command from other stations.

The conditions are therefore particularly favourable for obtaining better results than in hospitals whose cases are mixed, i.e. those antenatally examined and those not antenatally examined, but in some cases admitted as emergencies possibly after unsuccessful attempts at delivery, e.g. "failed forceps," have been made prior to admission.

The routine antenatal examination of women booked to enter the Louise Margaret Hospital for confinement was instituted by Colonel E. L. Moss, C.M.G., late R.A.M.C., in 1920, and has since been gradually developed in accordance with experience gained until, at the present time, the number of attendances per patient for antenatal examination has been so increased that the chances of mishaps due to conditions which could be foreseen have been reduced, not admittedly, as yet, to a minimum, but at any rate to a small figure.

One of the difficulties has been in securing the attendances of women

from out-stations due to lack of transport facilities. This has now been largely overcome.

The principle adopted in antenatal work has been the centralization of examinations and records at the Louise Margaret Hospital. To obtain good results I consider that the responsibility for antenatal examination must be with those who are to conduct the confinement, hence the centralization.

Co-operation on the part of the patients is an essential to success. Little difficulty is now found in obtaining this in most cases, despite the waiting that examination of a number of patients entails even with the most careful organization.

Pelvic disproportion, malpresentation and toxæmia are the most common conditions that are detected and for the most part may be regarded as preventable causes of serious mishap to mother and/or child.

Each year a number of cases of definite toxæmia in late pregnancy are admitted to the wards, usually recognized by urine test and blood-pressure readings before the condition is severe. Such "pre-eclamptic" cases nearly always respond to suitable medical treatment with or without the induction of premature labour at a suitable moment.

Cases of pelvic disproportion are admitted before term; induction of labour or Cæsarean section is performed, or in those border line cases that form so large a proportion of these, the progress of early labour is watched from the onset and appropriate treatment decided upon at an early stage.

Apart from these main classes, there is a constant number of cases in which pregnancy is superimposed on a pre-existing disease, e.g. cardiac disease or renal tubercle, diabetes, or severe varicose veins. The early recognition of pregnancy, sometimes by the Zondek-Aschheim test in such cases has enabled one to terminate pregnancy by hysterotomy and perform sterilization by excision of the tubes at an early stage before the damaged organs have suffered further from the strain of pregnancy. Pregnancy has been terminated for all the above mentioned conditions, thus reducing mortality and morbidity due to parturition.

On the other hand, there will always be those cases of unforeseen emergency which contribute to maternal mortality, chief among these must rank those of severe antepartum hæmorrhage. Success in the treatment of such cases largely depends on the stage in which they are first seen and on a correct or fortunate decision as to the best method of treatment in the particular case. One such case figures during the four years under review. Cæsarean section was successfully performed.

Eclampsia may develop rapidly, and in a few cases with hardly any premonitory symptoms—even in such cases the timely use of the sphygmomanometer may give warning by recording an initial rise in blood-pressure before albumin has appeared in the urine.

Induction of premature labour for pelvic disproportion has tended to be less commonly performed in this hospital. In 1929 labour was induced by

bougies on nine occasions against two and nil in 1930 and 1931. Opinion as to the desirability of this procedure is divided. Those in favour claim that by so doing they diminish the numbers of difficult labours and Cæsarean sections. Against those advantages must be balanced the difficulties of rearing premature infants and the risk of introduction of infection that is inseparable from the use of bougies however carefully they are introduced.

To ensure the passage of the fœtus through a contracted pelvis induction must be performed sufficiently early. The judgment required to effect this and yet obtain a maximum degree of maturity in the fœtus often presents a difficult problem.

Cases must be judged on their merits—the degree of importance attached to a living child, age of patient, etc., but Cæsarean section in many cases seems to offer the best solution. I have seen in consultation in outside practice a severe case of *Bacillus coli* septicæmia resulting from induction of labour by bougies.

Stillbirths.

The stillbirths in the above series include macerated fœtuses, hydrocephalic fœtuses and monstrosities.

The only cause of stillbirth I would discuss is breech presentation. If version to a head presentation was performed not only in primigravidæ, but also in multiparæ as a routine, then the stillbirth rate would be further reduced.

There is however an objection to performing version in every case in a teaching school for pupil midwives.

The Central Midwives Board continue to regard a breech case "when normal" (an anomaly in terms) as a "midwife's case." Pupils must therefore be instructed in the management of breech labour, i.e. they must conduct such deliveries. Therefore, selected cases in women who have children must be delivered as breech cases when normal breech labour may be reasonably anticipated.

The use of X-ray photographs may here be mentioned as of special help in the diagnosis of doubtful breech presentation and twins. We find it of the greatest value in such cases, complicated perhaps by hydramnios rendering accurate palpation difficult. It is of special value in the diagnosis of extended legs in breech cases and indicates the advisability of Cæsarean section in primigravidæ over thirty in whom this attitude of the fœtus is present.

Diet and Hygiene of Pregnancy.

Advice on both these headings is given at the antenatal clinics. Response to such advice is limited by: (*a*) The intelligence; (*b*) the pocket of the patient.

There is much evidence to show that a diet of adequate vitamins and calcium content and largely of a vegetarian or fruitarian nature diminishes

susceptibility to diseases associated with pregnancy and parturition. Surely we are only now beginning to realize and do not yet fully understand the part played by diet in the prevention of and predisposition to disease of many kinds.

The following table gives the total numbers of confinements conducted during the four years with a list of the chief complications met with.

	1928	1929	1930	1931
Confinements	604	489	484	581
Forceps cases	57	29	26	27
Adherent placenta	8	4	3	4
Contracted pelvis	17	3	9	5
Internal version performed ..	2	2	0	0
Face presentation	1	1	3	0
Eclampsia	1	1	1	2
Unreduced occiput posterior ..	24	14	15	15
Transverse presentation ..	1	0	0	0
Cæsarean section performed ..	5	5	9	9
Craniotomy performed ..	0	0	2	0
Maternal deaths	0	1 (eclampsia)	0	1 (eclampsia)
Stillbirths	16	14	13	8

Confinements—Total	=	2,158
Maternal deaths	=	2
Stillbirths	=	51 or 2·4 per cent.

Stillbirths include all cases in which the duration of pregnancy had reached or exceeded twenty-eight weeks and all cases of macerated fœtus, hydrocephalus, monstrosities, etc.

Of the 28 Cæsarean sections performed, 21 were performed for contracted pelvis, 4 for placenta prævia, 1 for fibroids, 1 for antepartum hæmorrhage and 1 for severe varicose veins.

HÆMOGLOBINURIA ON THE INDIAN FRONTIER.

A Second Communication.

By Colonel A. C. AMY, D.S.O.

A paper on this subject was published in the Journal of the Royal Army Medical Corps, issues of March, April and May, 1934. For a proper appreciation of the present communication, the original paper should be consulted. This paper is merely in continuation of the original. It brings to notice a recent case which ended fatally. This case is the first to be reported since August 13, 1933. It forms number eleven in order of incidence, and furnishes the seventh death. As in all the former cases, the patient was an Indian; the total amount of plasmoquine administered was small; the illness was rapid and severe; and stoppage of the drug immediately after it became evident that something was amiss produced not the slightest effect on the progress of the malady.

Patient's Particulars.—A Mussulman (Pathan) sepoy of an infantry regiment. Aged 28. Service, eleven years; in Waziristan, five; in Burma, four; and two years in the N.W. Frontier Province, where the present attack took place.

Past Army Medical History.—In January, 1931, on out-patient treatment for enlarged spleen. Spleen two finger breadths below costal margin. No malaria parasites found.

In February, 1934, admitted to hospital, and diagnosed "Malaria, clinical relapse." No malaria parasites found.

Present History.—On August 19, 1934, again admitted to hospital with "Malaria, clinical, relapse." No malaria parasites found at this, or at any subsequent date.

Atebrin, 0·1 gramme, t.d.s., administered for seven days. Total atebrin taken, 2·1 grammes, spread evenly over one week.

Atebrin present in the urine on fourth day of the course. No toxic signs or symptoms.

On August 29, 1934, patient was discharged from hospital. Interval between cessation of atebrin course and commencement of plasmoquine course—four days.

On August 30 and 31, and on September 1, 0·01 gramme plasmoquine, b.d., was given. No more plasmoquine, or other antimalarial drugs were administered thereafter. Total plasmoquine taken, 0·06 gramme, spread evenly over three days.

Onset.—Sudden: one hour after administration of second dose of plasmoquine, on September 1.

Severe pain in epigastrium and back; severe nausea and vomiting; stools and urine black in colour.

Condition on Admission to Hospital, September 2.—Temperature 99·6° F. Pulse 82, of good volume and tension. Respirations 20. Mentally quiet and rational. Generalized icterus well marked in the conjunctivæ. Epigastrium painful and tender. Spleen enlarged to a hand-breadth below the costal margin. Liver palpable, but not tender.

Blood: Red blood cells, 3,125,000; hæmoglobin, 60 per cent.; white blood cells 8,750; polymorphonuclears 68 per cent; large mononuclears 5 per cent; lymphocytes 27 per cent; eosinophils nil.

Urine: Passed in small quantities; eight ounces this morning. Colour, smoky to black. Acid reaction. Albumin abundant. Granular and tube casts plentiful, and red blood corpuscles present in a heavy, brown, amorphous deposit. District Laboratory reported hæmoglobin, as well as red blood cells.

Stools: Semi-solid, black. District Laboratory report on the presence of blood was negative.

Treatment: General, with two intravenous injections of saline, sod. bicarb. and glucose.

Progress.—On the morning of September 3, nausea and vomiting had ceased, but the jaundice had deepened, no urine had been passed and the stools remained black. A slight improvement in the general condition was recorded.

At noon 10 ounces of urine, and at 11 p.m. 15 ounces of urine were passed. Examination of the urine yielded the same results as on September 2.

On September 4, temperature 100° F. and pulse 104. General strength maintained.

This morning, two ounces of a one per cent solution of methylene blue were administered intravenously; and at noon an intravenous solution of saline, sod. bicarb.-glucose was given. The latter had to be cut short, owing to the onset of a very severe rigor.

From this date, suppression of urine set in.

September 5: From this day onwards, anuria was complete, and the patient's condition steadily deteriorated.

Saline injections were continued, and on September 7 the methylene blue injection was repeated.

On September 8 the red blood cells numbered only 2,400,000, and the hæmoglobin percentage had fallen to 50. Blood transfusion was carried out.

A second blood transfusion was given on September 9, when the red blood cells count was down to 1,100,000, and the hæmoglobin fell to 25 per cent.

The patient made no response to treatment, and death occurred on the morning of September 10.

Notes.—By the officer in command of the patient's hospital :—

"A most excêptional case. . . . There is no question of an overdose of plasmoquine, as this drug is only in the hands of the sub-assistant surgeon who personally gives it out."

By the District Medical Specialist :—

"This man was under treatment for an attack of malaria, parasites were not found in the blood, but the clinical condition left little doubt about the diagnosis. . . . I saw the register of out-patient plasmoquine treatment, and there appears to be no doubt that the man received only the prescribed dosage of the drug."

Remarks.—This case bears a strong general resemblance to the cases which were described in this Journal in March to May of 1934; and, in individual characteristics, it is identical with some of these cases.

It is of great interest to note that methylene blue, even in heavy dosage (it was given somewhat late in the attack), produced no effect.

This at once raises the question: did the hæmoglobinuria take the form of oxyhæmoglobinuria or methæmoglobinuria?

Although it is known that the former is no more pathognomonic of blackwater fever[1] than the latter is pathognomonic of plasmoquine poisoning, still there is—in the light of our present knowledge of hæmoglobinuria—a balance of diagnostic probability when one or other of these two forms occurs, or predominates, especially in the earlier stages of the attack.

In this case the clinical records give no indication as to whether the medical attendants were dealing with oxy- or with methæmoglobinuria. After all that has been written and said on this subject, it is disappointing to find that the District Laboratory concerned failed to make the requisite differentiation; and that the clinicians concerned failed to call for this most important information.

Why is it of such importance to employ the spectroscope in these obscure cases?

Because an early report of oxyhæmoglobinuria or of methæmoglobinuria, as the case may be, will perhaps carry us a big step forward in the solution of a vexing and vital problem.

This problem may be restated thus:—

(1) Does true blackwater fever occur, as an entity, amongst natives in the west and north-west of India?

(2) Are these cases simply and solely due to plasmoquine poisoning?

(3) Can plasmoquine alone, or in combination with one or more unknown factors, precipitate an attack of what we call blackwater fever?

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[1] For the latest work on this subject, see "Laboratory Studies in Malaria and Blackwater Fever. Part II. Blackwater Fever. Hæmoglobinæmia." N. Hamilton Fairley and R. J. Bromfield. *Transactions of the Royal Society of Tropical Medicine and Hygiene.* Vol. xxviii, No. 2. August 4, 1934.

Unfortunately, the case now recorded leads us no farther on the way to an answer to any one of the three questions comprising our present hæmoglobinuric problem; but it presents certain features which have called forth this communication. It was a soldier—Napoleon—who said that: "Repetition is the figure of speech for the crowd"; and it seems to us that, at present, some hope of successful diagnosis lies in concentrating on the intimate blood changes which occur in this perplexing malady. And as for prophylaxis, why are these eleven patients all Indians?[1] The answer to this question may provide a clue; but, to date, this riddle, too, remains unsolved.

[1] In military medical practice in India, the sepoy only receives two-thirds of the dose of plasmoquine given to the British soldier; and his maximum daily dose is only 0·02 gramme.

Editorial.

THE STATE OF THE PUBLIC HEALTH.

In 1911 the National Insurance Act was passed and dealt, as regards tuberculosis in insured persons, with domiciliary treatment, the erection of sanatoria, research, and education. Then followed the appointment of a Departmental Committee, the findings of which, published in 1912-13, provided the basis of the Tuberculosis Schemes of Local Authorities which are now operative throughout the country. The Committee regarded the Tuberculosis Dispensary as the first unit in a tuberculosis scheme; the second unit comprised sanatoria, hospitals and other institutions. It was estimated that one sanatorium and one hospital bed per 5,000 of the population in the United Kingdom would be necessary—experience showed that in industrial areas this standard was insufficient. The Departmental Committee created the post of Tuberculosis Officer who was to administer the dispensary and to act as consultant to the general practitioner and school medical officer. The Committee also recommended the establishment of open-air schools and open-air classes for tuberculous children, as they regarded childhood as the most important time for preventing tuberculosis. In their final report they dealt with preventive work, research, and bovine tuberculosis.

When the Ministry of Health was founded in 1919 tuberculosis became the concern of a special department in the Ministry and central control was unified.

The Public Health (Tuberculosis) Act of 1921 made the formulation of tuberculosis schemes compulsory, devolved the provision of sanatorium treatment on local authorities, and did away with the distinction between insured and uninsured tuberculous patients.

Sir George Newman says that we cannot assign to one special factor or another the credit for the general improvement observed, but statistics prove all forms of tuberculosis are declining in our midst. He considers that nothing in the experience of twenty-one years casts any doubt on the soundness of the lines of action laid down by the Departmental Committee. In 1911, before the setting up of the national scheme for combating tuberculosis, there were in England and Wales 38,422 deaths from tuberculosis of the respiratory system, a figure which in 1933 had declined to 27,854. The diminution in the number of deaths from other forms of tuberculosis is even more remarkable. In 1911 these deaths were 14,698; in 1933 they had fallen to 5,405.

In tuberculosis schemes two main difficulties have been experienced: the first great difficulty is the detection of the early case and the examina-

tion of contacts; the second is the after-care of the patient whose disease has been arrested by treatment. His medical supervision could be arranged for, but his home surroundings and conditions of work frequently cannot be adjusted to his physical condition. This was the occasion for the foundation of village settlements.

The death-rate from all forms of tuberculosis in 1933 was the lowest on record. In the decade 1871-1880 there were 69,757 deaths, while in the decade 1921-1930 there were 39,379 deaths.

A rise in the death rate from tuberculosis in females aged 15 to 25 became apparent in 1917 and has not yet been definitely explained. Whatever the causes, they also affected young males but to a lesser degree. Some parts of the country showed widely different rates in young adult mortality. The distribution of high and low rates was so erratic that geographical situation seemed to have little to do with it. The increase in this mortality prominent in Tyneside and Durham has not appeared in Lancashire.

During 1933, 66,531 new cases were notified in England and Wales. Many Medical Officers of Health comment in their annual reports on the late stage of the disease when notification was made. The Medical Officer of Health for Plymouth states that 50 per cent of patients died from tuberculosis within a year of notification. The weight of evidence seems to justify the conclusion that the main reason for late notification is the unwillingness of the patient to seek medical aid.

Sir George Newman states that at present the figures of new cases remain relatively stationary year by year and that the primary problem to-day is for the tuberculosis service to establish contact with patients to a far greater extent while the disease is still in a stage in which recovery is possible. He also considers that every efficient large sanatorium should be a *sanatorium hospital* capable of dealing with all its patients on up-to-date lines, medical or surgical. The former idea that a sanatorium is only suitable for early cases has been abandoned. It has been found that patients with more extensive or even advanced disease may become suitable for sanatorium treatment.

The position of the smaller sanatoria with less than 100 beds is becoming increasingly difficult, as in many instances they have not the medical facilities and cannot afford the expense of a staff specially trained in modern methods of treatment. They may be suitable for cases under observation with a view to diagnosis and for the treatment of cases whose prospects of recovery are remote. The medical superintendents, tuberculosis officers and medical practitioners should be in effective co-operation if the best results are to be obtained.

The Annual Reports of the Ministry have declared for some years that artificial pneumothorax, together with other surgical measures, have revolutionized the treatment of chronic pulmonary tuberculosis. In the Report for 1933 Sir George Newman gives short notes on the history of

artificial pneumothorax, which was suggested in 1822 by Dr. James Carson, of Liverpool, on the purpose of the operation, the method, selection of cases and contra-indications. Dr. A. Lisle Punch considers that artificial pneumothorax is a valuable form of treatment for something under five per cent of all cases of pulmonary tuberculosis, but the remaining ninety-five per cent of cases have to be treated by the old methods of diet, hygiene and climate.

A special report to the London County Council has analysed the results of treatment of tuberculous patients ten years after their discharge in the year 1921 from residential institutions. The return of patients treated under the tuberculosis scheme shows that the number of deaths during the first five years after discharge was heavy, but that "those patients who survived for the first five years following residential treatment continued to survive except for an annual wastage of five per cent per annum." The report supports the administrative procedure of the Ministry in recommending that patients who have shown no evidence of activity of the disease for five years may be regarded as having recovered and be removed from the dispensary register.

As regards capacity for work sixty-five per cent of those alive in 1931 were fit for work, fifty per cent of the surviving men were known to be employed, and ninety per cent of the surviving children, many of whom had reached adult age, were at work or at school.

The Venereal Diseases Scheme for this country set up on the recommendation of a Royal Commission has been in operation for nearly eighteen years. Under it the County and County Borough Councils have set up, either through voluntary hospitals or in premises administered directly by themselves, a large number of treatment centres and have carried out, either directly or through the agency of the British Social Hygiene Council, a more or less continuous education of the public. Sir George Newman takes this opportunity to review the results of the scheme in respect of syphilis, soft chancre and gonorrhœa.

As regards syphilis the indications are that the Scheme has been a success: inquiries show that the majority of persons infected with this disease resort to treatment centres. The Returns show that the cases dealt with for the first-time at the centres in England and Wales, after rising to a maximum of 42,805 in 1920 fell rapidly to 22,010 in 1924, from which year until 1932 the numbers fluctuated between 22,019 (in 1929) and 23,395 (in 1927), falling in 1933 to 21,525, the lowest yet recorded.

Evidence of the success in educational efforts is found in the lessened incidence of transmission of syphilis to wives and children. This may be partly due to the fact that large numbers of men have attended at the centres to ascertain whether they are free from infection before marrying and partly to the lessened incidence of syphilis. Further evidence of the success of the educational efforts is to be found in the lessening of the

delay between the first appearance of the disease and first resort to a treatment centre. Another evidence is the scarcity of cases showing external signs of the disease: mutilating ulceration and destruction of bones of the face, once common features, are rarely seen to-day.

In the section on the relation of food to health and disease reference is made to reports issued by the Ministry's Special Advisory Committee on nutrition and to the apparent divergencies between the recommendations of this Committee as regards calories and first-class protein and those suggested by the Committee of the British Medical Association. We referred to this question in our Editorial on the Nutrition Question and gave the findings of the joint conference of members of the two Committees. In order to provide standard energy requirements as a guide for the nutrition of different catagories of people a sliding scale was drawn up, but the conference was careful to point out the uniqueness of each individual's food requirements, and stated that the scale must be regarded as approximate only.

Malnutrition, which has assumed special importance lately owing to unemployment, is fully discussed by Sir George Newman who points out that disordered metabolism may be brought about by deficiency or excess. In regard to deficiency, a diet may be poor in all food constituents or in one or more of them. All-round deficiency would lead in the child to stunted growth and general under-development as well as to loss of vitality and lassitude, which would be the chief effects in the adult.

The effects of inadequate ingestion of single food constituents will depend on the rôle played by the particular food factor in the living body. Thus, a deficiency of calcium during the growth period would result in poor development of the bony skeleton. It has been shown that proper functioning of contractile tissue depends on a certain concentration of calcium ions in the blood and if these be lowered the musculature of the alimentary and circulatory systems will not function in a proper manner. There is also evidence for believing that the absorption of carbohydrates would be reduced by deficiency of calcium in the blood. The metabolism of calcium is intimately bound up with that of phosphorus and with the function of the parathyroid gland. It is also known that calcium plays an important part in maintaining the selective permeability which is an essential characteristic of all living cells and it therefore follows that there is hardly a function of the body which would not be adversely affected by continued ingestion of diets low in calcium.

An excess of food overtaxes the organs of digestion, assimilation, and excretion, and Orr and Gilks have shown that excessive ingestion of animal protein leads to increased susceptibility to digestive diseases and to rheumatoid arthritis. In the growing period excessive consumption of energy-giving foods would lead to disproportionate development of soft parts relative to the bony skeleton. Children fed in this way are liable to become

flabby and apathetic. It is evident that malnutrition is a very complex condition and though gross malnutrition is easy to diagnose, the slighter forms, which in the long run may have a great effect on the health of the body, are difficult to determine, and may easily escape recognition.

There are at present no objective or physical tests by which the state of nutrition of the individual can be determined. Measurements of height and weight have only a restrictive value for this purpose. Laboratory tests such as the estimation of hæmoglobin, though valuable in special cases, are not generally applicable. Cathcart has found that in persons of good physique and of the same age the ratio of strength to weight remains reasonably constant and it has been found possible to construct a single instrument for measuring the strength of an individual in terms of the force of his "pull." Investigations are now being made to ascertain whether the ratio of strength to weight affords an index of nutritional condition.

Sir George Newman points out that at present the estimation of factors in malnutrition by the investigator cannot be based on objective data; the standards, consequently, that he forms are mental concepts and incapable of precise measurement. The effects of industrial depression on populations are material and psychological, and the latter effects are considered to be the more serious. Lack of money might lead to malnutrition and also to a lowering of parental efficiency. Paton, Cathcart and their colleagues have studied the diet and social conditions of various classes for several years and were not able to find any constant relation between income and health, but they did find a constant relation between health and parental efficiency.

The effects of unemployment on the national health were considered at great length in Sir George Newman's report for 1932 and further information obtained in 1933 confirms the conclusions then arrived at. There has been no *general* increase of mortality among the unemployed or their dependants or even in the depressed areas as a whole. There has been no special undernourishment of young children. In 1910 evidence of undernourishment was found in 11 per cent of the children entering schools in London and in some places the incidence was 20 to 30 per cent. In 1933 the percentage of malnutrition among school entrants and older children had fallen to one-quarter or less of the earlier incidence, and in London it had fallen to less than 1 per cent.

Reports on the insured population by Regional Medical Officers indicate that, except in certain localised areas, e.g., the Tyneside and other dockyard areas on the N.E. seaboard, there has been no general excess of sickness, ill-health, or physical incapacity attributable to unemployment. Malnutrition is not a prominent feature, nor does it seem to be widespread or increasing. There is some evidence of illness of a neurasthenic type, especially in Northumberland, Tyneside, and Manchester and Liverpool districts. In S. Wales and N.W. Cumberland the effects of unemployment are less evident than they were.

In the Ministry's Pathological Laboratory several years' work has been devoted to the serological classification of *Streptococcus pyogenes*, and it is now considered that this group of hæmolytic streptococci is made up of a number of serological races, which can be identified as the causal agents of tonsillitis, scarlatina, puerperal fever, erysipelas, &c. Dr. Griffiths' work leads to the conclusion that scarlet fever cannot be regarded as a specific disease like cholera or plague, but it is simply one of the protean manifestations of infection with *S. pyogenes*.

It has been found that the incidence of the types of streptococci in scarlet fever varies in different localities and reflects the clinical character of the prevailing streptococcal infection. At the present time Type 2 streptococcus appears to be the chief epidemic type in this country.

A study of streptococcal infections in schools has shown that quite a number of well-defined types are responsible for the great majority of epidemics in this country. It is stated that outbreaks of scarlet fever, that is to say, streptococcal infections with erythrotoxigenic strains, seem on occasions to be checked by measures of isolation, whereas the spread of non-toxigenic (i.e., not producing Dick-toxin) strains continues for one or more terms. From the epidemiological point of view, since tonsillitis in one person may give rise to scarlet fever in another, and *vice versa*, there appears to be little justification for treating present-day scarlet fever in regard to segregation differently from cases of epidemic tonsillitis. It is thought that stricter precautions should be taken in the school sanatorium, which is often a focus of infection contributing to the spread of epidemic tonsillitis.

Since the establishment of the Ministry's Malaria Laboratory in 1925 a pure strain of benign tertian malaria cultivated in mosquitoes for the purposes of malaria therapy has been supplied to 230 hospitals in England, Wales, Scotland and Ireland, and has been used for the inoculation of more than 2,000 patients. The strain has also been successfully conveyed in mosquitoes to Holland, Italy, Malta, and Roumania for the purpose of malaria therapy in those countries.

The Horton Mental Hospital is the centre for malaria therapy and where the strain is cultivated in mosquitoes, and where various procedures for improving the technique of the treatment are tried out. One is the use of other species of mosquitoes; another is allowing the malaria infection to persist for a long period; a third is the repetition of the course with a different kind of malaria than that with which the first attack was induced. The purpose of these trials is to endeavour to obtain better results in killing the causal organism of general paralysis than are obtained by the technique which has been in use in the world generally for fifteen years. The practice of malaria therapy does not seem to be increasing; up to now it has been tried in only about half the borough and county mental hospitals. In any of the past five years not more than 640 patients have been treated, though general paralysis causes more than 1,000 deaths every year.

At Horton during 1933 prophylactic tests were made with atebrin to ascertain whether this drug would give better results than quinine in the control of malaria on ships trading to West Africa and other malarious countries. The results of the laboratory tests show that a person who takes a daily dose of three tablets of atebrin (each containing 0·1 g.) during the period of liability to malaria infection by the bites of mosquitoes and for five days after his last exposure to the risk of being bitten will remain free from a malaria attack for at least three months. As regards protection against the malignant tertian type, the trials show that a person who has taken atebrin prophylactically in the manner stated will be completely protected against an attack until the next occasion on which he is bitten by infected mosquitoes. As regards protection against the benign tertian type, the person treated usually remained free from an attack for eight months, but exceptionally an attack might develop as early as three months after the prophylactic doses were taken.

On the basis of these laboratory experiments it would seem better for a crew to take the short course of atebrin than, as at present, to take a dose of quinine on arrival in a malarious port and every day thereafter until the ship has arrived again at its home port.

The number of vessels fumigated with hydrogen cyanide in 1933 was more than double those similarly treated in 1932 and nearly four times the number dealt with in 1929.

Certain countries having declined to accept deratisation certificates issued after fumigation by burning sulphur in open pots, it was decided to determine under practical conditions the actual concentrations of gas obtained by the method. The technique was strictly on the lines that would be followed had the fumigation been done to obtain an international deratisation certificate. The main object of the experiments was to determine whether the concentration of sulphur in empty ships was sufficient to cause the destruction of rats. Contrary to expectation it was found that fumes from burning sulphur appeared to enter pipe casings more readily than hydrogen cyanide. By burning good quality sulphur in trays in the proportion of 3 lbs. per 1,000 cubic feet of space the concentration of sulphur dioxide lethal to rats was reached and maintained far longer than the lethal period.

It seems clear that all authorities can safely accept the open method of burning sulphur as a practical and efficient method for the fumigation of empty ships in order adequately to meet the requirements of Article 28 of the International Sanitary Convention.

Clinical and other Notes.

NOTES ON THE TREATMENT OF ACUTE PNEUMONIA BY A CONVALESCENT SERUM.

By Brevet Colonel R. PRIEST, K.H.P.,
Royal Army Medical Corps.

"Pneumonia, one of the most widespread and fatal of all acute diseases, has become the *Captain of the Men of Death*, to use the phrase applied by John Bunyan to consumption." Such are the opening words of Osler when treating of the incidence of this disease. There is an impression, imprinted more deeply on the lay than on the professional mind, that pneumonia is a disease of the cold winter and early months associated, perhaps, with adverse conditions of climate. A study, however, of the records of the Citadel Military Hospital, Cairo, for the years 1929—1933, where the climate is hot during May and June and very warm and humid during July, August and September, will show that pneumonia tends to be a disease of the summer months, the greatest incidence occurring between May and September and the maximum number of admissions in any one month happening either in June, July or August. For example, in 1933, there were 53 cases out of the yearly total of 68 admissions between May and September, with a maximum of 22 cases admitted during June. In Cairo, therefore, pneumonia has been more prevalent during the summer months. The cause of this reversal of the general impression is not easy to discover and is still under investigation. Regarding the mortality in Cairo in 1933 the number of deaths among a civil population of 1,233,500 was 5,139 (4·16 per 1,000). In the same year among troops in the Cairo area, whose average strength was 6,439, the number of deaths from pneumonia for the whole year was 7 (1·08 per 1,000 strength), a case mortality of 10·3 per cent. Between May and September, the period of greatest incidence, the case mortality was 13·2 per cent. The annual reports on the Health of the Army show that the case mortality among the Regular Army serving at Home and Abroad lies between 9 and 10 per cent. It will be seen, therefore, that the opening words of Osler quoted above are almost as true to-day as when he wrote them. This being the case, every effort should be made to discover some means whereby the incidence and mortality of this widespread disease may be lessened. The number and the variety of the forms of treatment that have been suggested are legion and their very number indicates that no great measure of success has attended any one of them. Be this as it may, no apology is needed for suggesting yet another mode of therapy. In May of 1934 the summer wave of admissions

for acute pneumonia commenced and on examination it was learnt that the *Diplococcus pneumoniæ* recovered from the sputa of all these early cases belonged to Type II, Armstrong's rapid method of typing being used in all instances. Sabin's method of typing did not prove a success, possibly because guinea-pigs were used instead of mice, none of the latter being available. It was only late in July that a change of type occurred in a patient whose sputum produced Type I. It was at the period when patients who were very ill continued to arrive in fairly rapid succession that it occurred to me that the giving of the serum from the convalescents would be perhaps more beneficial and helpful to the fresh pneumonia patients than the administration of the available stock serum. It is not claimed that the treatment of acute pneumonia by convalescent serum is new but I could find no reference to this form of therapy in the literature at my disposal and so, as no data were available, I had to proceed carefully by trial from the beginning, instead of being able to go ahead from a stage where others had left off. Some difficulties in obtaining sufficient serum presented themselves: firstly, the pneumonia patients were very exhausted for a few days after the temperature had been normal and one was reluctant to disturb them; secondly, as soon as convalescence was established, i.e., from about the fifth or seventh day after defervescence, it seemed unfair to ask them to part with twenty or more ounces of blood. In this investigation, therefore, one had to be content with as much blood as could be removed from each convalescent by a twenty cubic centimetre syringe. At the next opportunity it may be possible to obtain a larger quantity without harm or causing alarm to the patients in their debilitated condition. Blood was taken from a total of eleven convalescents on or as soon as possible after the seventh day after the temperature had fallen to normal. In each instance the medical history sheet was perused for evidence of antecedent disease. The blood was examined for malarial parasites. The serum was pipetted off after twenty-four hours and was placed in the water bath at 56° C. for half an hour for three or more days in succession, depending upon the day the serum was required. The Kahn test was carried out on all sera. At this point it should be mentioned that the sera of Type II convalescents agglutinated their own organism but not the pneumococcus Type I isolated from the sputum of a patient who was admitted late in July, thus demonstrating the presence of some specific antibody in the convalescent serum.

The serum was in all instances administered by injection under the skin of the flanks. Having no guide on which to base the dosage and in the absence of any means of estimating the antitoxic power of the serum, it was considered wise in this series to commence with small trial doses. The clinical results were briefly as follows :—

Case 1.—A very severe infection. He received 10 cubic centimetres of convalescent serum on the fifth, sixth and seventh days of his illness. After the third injection there was a distinct amelioration in his general

condition. Crisis occurred on the eighth and ninth day and the temperature came to normal on the tenth day. He was too ill at the time to remember anything and so could not say whether he felt better for the injections or not.

Case 2.—A less severe case who on the third and fourth days of illness received 10 cubic centimetres. It was noted that the temperature began to fall on the fourth day and reached normal by lysis on the eighth day. This patient said that after the second injection he felt "champion."

Case 3.—Was the best advocate of the treatment for, after receiving the first injection of 9 cubic centimetres on the fourth day of illness, he volunteered the statement that the injection took away the tight, blown-out feeling in his chest, and made his breathing easier and not so painful; the second injection (on the fifth day of 10 cubic centimetres), he said, cured him.

His temperature began to fall on the fourth day and continued to fall by gradual lysis and reached normal on the eleventh morning. After the fifth day the temperature did not rise above 100° F.

Case 4.—A very acute severe infection for whom, unfortunately, only 17 cubic centimetres of convalescent serum were available and this was administered in doses of 8 and 9 cubic centimetres on the seventh and sixth days of the illness. It cannot be said that the serum had any great effect upon his general condition, but it was noted that on the seventh day the temperature showed a big fall and reached 96·8° F. on the tenth morning. This fall in temperature, which, it should be noted, was seen in all four cases within twenty-four hours of the last injection, might have occurred in the natural course of the disease without the injection of the serum, therefore observations upon many more cases are necessary before one can say whether the defervescence was due to the serum or to coincidence.

There was no sign of serum reaction, local or general, in any of the patients.

The result of this investigation, although not dramatic, is encouraging and should a similar series of cases present itself this year it is intended to give this form of treatment a further and more extended trial by administration of larger quantities of serum either intravenously or subcutaneously. It is hoped also that by publication of these notes others will be induced to do the same so that as many observations as possible may be collected and compared. The injection of the whole blood of a man convalescent from malaria and free from syphilis into the muscles of an actively ill patient is also put forward as worthy of trial. In this series it was not possible to give the serum earlier than the third day, this being the earliest opportunity after the arrival of the patients in the acute medical ward. From the pathologist's point of view the investigation is obviously incomplete, but it was the best that could be carried out at this period. Still, some data were obtained and the clinical results would appear to justify a fuller

investigation this year when a small research laboratory, set apart from the general laboratory, could be arranged.

My thanks are due to Colonel J. H. Campbell, D.S.O., D.D.M.S., British Troops in Egypt, for permission to make this investigation and to send these notes for publication; to Lieutenant-Colonel W. Mathieson, O.B.E., R.A.M.C., in charge of the Medical Division and Acute Medical Ward for his co-operation; to Lieutenant-Colonel J. B. A. Wigmore, R.A.M.C., for his help and collaboration and also for the pathological notes which are incorporated in this report.

A CASE OF AGRANULOCYTOSIS.

By Major H. B. F. DIXON, M.C.,
Royal Army Medical Corps,

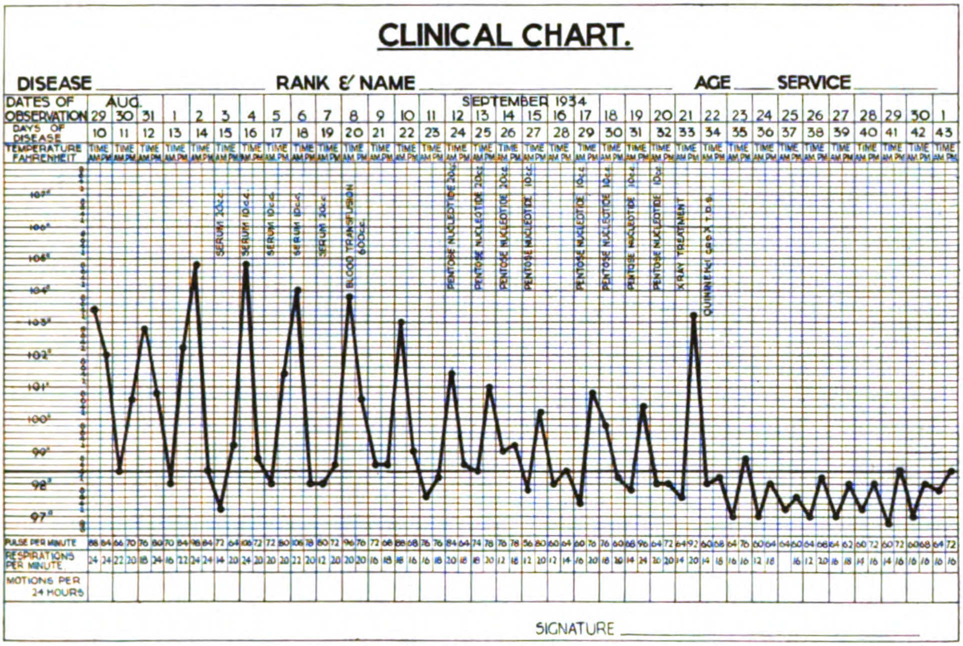
AND

D. W. SMITHERS, M.B., B.Chir.,
Civilian Medical Practitioner.

The patient, aged 28, was admitted to the Queen Alexandra Military Hospital, Millbank, on August 29, 1934. He had returned from India five months previously, having served there for three and a half years. He had always been a healthy man and had had no previous serious illness. While in India he had suffered from occasional fever lasting for one day at a time, for which he had treated himself with esanofele; he had never been in hospital.

On August 20 he woke up with acute abdominal pain, he sweated profusely, had a rigor, and vomited twice. He was seen by his doctor, who said his temperature was 105° F. For the next four days he had severe headache and his high temperature persisted. He was then sent to a civil hospital, where it was noted that the rise in temperature occurred every other day. The Widal reaction against typhoid, Para A and B, was negative; nothing could be found to account for his pyrexia, and on the tenth day of his illness he was transferred to Millbank.

On admission, therefore, he presented the problem of "a pyrexia of unknown origin" of ten days' duration. He complained only of severe frontal headache, inability to sleep, and constipation. His bowels had only been open twice since the onset, each time with an enema. His temperature was 103·4° F., pulse-rate 88, and respiration 24. His tongue was furred and brown, his mouth very dry, and his throat injected; there was some enlargement of the cervical glands; no ulceration was present in the mouth or throat. He presented no other abnormal physical signs in any system, and his spleen was not palpable. The following investigations were carried out:—


CLINICAL CHART.
DISEASE
RANK & NAME
AGE
SERVICE
DATES OF OBSERVATION
AUG.
SEPTEMBER 1934
DAYS OF DISEASE
TEMPERATURE FAHRENHEIT
SERUM 20cc
SERUM 10cc
SERUM 10cc
SERUM 10cc
SERUM 20cc
BLOOD TRANSFUSION 600cc
PENTOSE NUCLEOTIDE 20cc
PENTOSE NUCLEOTIDE 20cc
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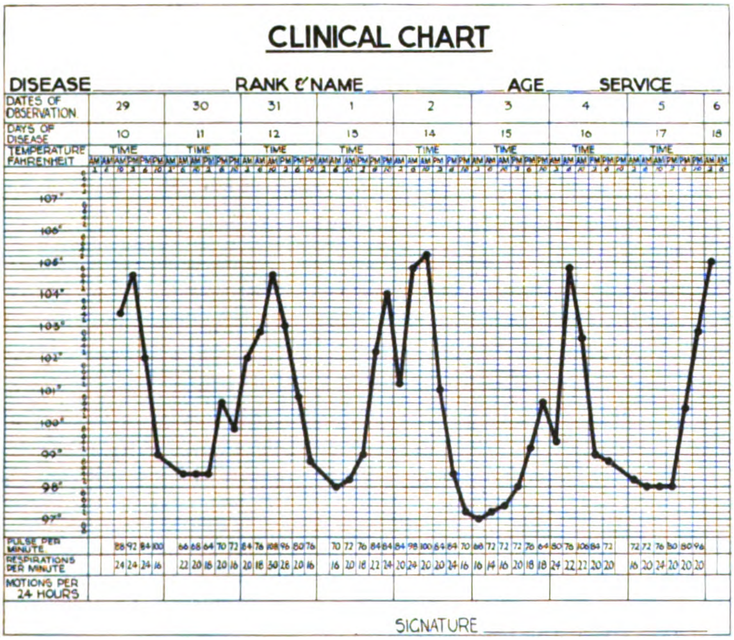
XRAY TREATMENT
QUININE HCl GR.X T.D.S.
PULSE PER MINUTE
RESPIRATIONS PER MINUTE
MOTIONS PER 24 HOURS
SIGNATURE


CLINICAL CHART
DISEASE
RANK & NAME
AGE
SERVICE
DATES OF OBSERVATION
DAYS OF DISEASE
TEMPERATURE FAHRENHEIT
PULSE PER MINUTE
RESPIRATIONS PER MINUTE
MOTIONS PER 24 HOURS
SIGNATURE

August 29, 1934 : Blood culture, sterile. Stool culture, no non-lactose fermenters isolated. Blood-count: hæmoglobin 80 per cent; red cells 5,752,000; white cells 4,600; polymorphs 54 per cent; lymphocytes 38 per cent; monocytes 5 per cent; basophils 1 per cent; eosinophils 2 per cent. Serum reaction negative to typhoid, Para A, B and C, Shiga and Flexner group, *melitensis* and *abortus*. Urine acid, specific gravity 1,016, no albumin, no sugar, culture sterile. Blood-slides (several taken at various stages through the day and night), no malaria parasites seen. Throat swab, non-hæmolytic streptococci and staphylococci present.

September 1 : Lumbar puncture, cerebrospinal fluid clear, not under increased pressure, four lymphocytes per cubic millimetre, no increase in globulin, sugar nil, culture sterile, Wassermann reaction negative, Lange's colloidal gold curve normal.

September 2: Wassermann reaction of the blood positive, Kahn negative. Repeat of stool and urine cultures negative. Weil Felix reaction negative in all dilutions. Blood-slides, no malaria parasites seen. Blood-count, polymorphs 56 per cent, lymphocytes 36 per cent. Blood-culture (put up on September 1) positive; growth of a short chain non-hæmolytic streptococcus obtained.

At this stage the patient had been in hospital for five days with a high swinging temperature rising every other day to 104° or 105° F. The pulse-rate, even with the temperature at 105° F., had never risen above 108, there was no rise in the white-cell count and no increase in the percentage of polymorphs. On the positive blood-culture, however, a diagnosis of streptococcal septicæmia was made. No focus of infection, beyond a mildly inflamed throat from which a non-hæmolytic streptococcus was obtained, could be found.

During the next five days a total of 80 cubic centimetres of Dick's anti-scarlatinal serum were given intramuscularly with no marked effect on the patient's general condition or temperature. On September 8 a blood-count showed: hæmoglobin 55 per cent, red cells 3,100,000, white cells 3,000. A blood transfusion of 600 cubic centimetres was then given. The pyrexia continued as before, the patient complained of severe headache during the rise in temperature, but felt comparatively well when the temperature fell. On September 10, a white cell count showed 2,400 cells, polymorphs 18 per cent, myelocytes and metamyelocytes 33 per cent, lymphocytes 43 per cent and monocytes 6 per cent. The patient developed a generalized serum rash. On September 11, red cells were 4,200,000, white cells 3,600, polymorphs 10 per cent, lymphocytes 34 per cent, eosinophils 3 per cent, monocytes 3 per cent, and 50 per cent primitive granular types; some red cells showed punctate basophilia.

On September 12, treatment was started with injections twice daily of pentnucleotide 10 cubic centimetres (0·7 gramme per 10 cubic centimetres) intramuscularly. The patient's general condition was much worse, he was very pale, slightly puffy under the eyes, and became delirious when the

temperature rose. On September 13 the white cell count was 2,800, and of 100 cells counted only 2 were granular, 1 being a basophil; 3 türk cells were seen and some polychromatic red cells; no punctate basophilia was observed. On September 14 the blood-picture had improved, this being the third day of treatment. The white-cell count was 3,500 with 12 per cent granular forms, including two band form polymorphs; punctate basophilia was seen in some red cells. On September 15 white cells were 4,200. In the evening the patient complained of abdominal pain and looked very ill and distressed; respirations were twelve per minute. The evening injection was withheld and no injections were given next day, during which time the patient's general condition slowly improved. On September 17 one 10 cubic centimetre injection only was given. White cell count 4,200, granular cells 55 per cent, lymphocytes 45 per cent. The granular cells consisted of 4 myelocytes, 6 metamyelocytes, 15 band forms, 27 polymorphs, 2 basophils, and 1 eosinophil. Hæmoglobin 56 per cent. Red cells 3,670,000. The injections were continued once daily for the next three days, the patient suffering no further ill-effects beyond a feeling of nausea lasting for about one hour after each injection. On September 18, white cells were 4,400, lymphocytes 41 per cent, granular forms 59 per cent. The granular cells consisted of 5 myelocytes, 3 metamyelocytes, 18 band forms, 31 polymorphs and 2 eosinophils. September 20, white cells 4,800, lymphocytes 36 per cent, granular forms 63 per cent, with 1 myelocyte, 8 metamyelocytes, 15 band forms, and 39 polymorphs. September 21, white cells 5,600. The patient had received a total of 110 cubic centimetres of pentnucleotide; his general condition was greatly improved, but the swinging temperature persisted, the peak being reduced to between 100° and 101° F. He was then given one X-ray treatment of 80 kilovolts, 4 milliamps of current through a filter of 1½ millimetres of aluminium at a distance of 33 centimetres for three minutes to each tibia. The next day malaria parasites (gametocyte, benign tertian and 2 ring forms) were seen in a blood-film, the temperature having risen to 103·2° F. Blood-slides had been examined almost daily since admission, and no parasites had previously been seen. The patient was given 10 grains of quinine hydrochloride three times a day with an instant response; the temperature rose the next day to 99° F. and thereafter remained normal. September 24, blood-count: hæmoglobin 70 per cent, red cells 3,900,000, white cells 6,000. The Wassermann reaction, which was positive on admission, was strongly positive on September 11, and negative on September 18; the Kahn test was negative throughout; there was no history of syphilis. The patient was given 30 grains of ferri et ammon. cit. three times a day, and a final blood-count on October 8, 1934, before discharge from hospital, was: Hæmoglobin 70 per cent, red cells 4,300,000, white cells 6,600, polymorphs 56 per cent, lymphocytes 33 per cent, eosinophils 4 per cent, basophils 3 per cent, and monocytes 4 per cent; no primitive granular cells were seen. The patient felt rather weak, but otherwise perfectly well.

SUMMARY.

A patient with a history of possible previous attacks of malaria ran a high swinging temperature rising every other day, presented no abnormal physical signs beyond an injected throat. On the tenth day of his illness the blood culture was sterile but on the twelfth day a growth of non-hæmolytic streptococci was obtained. The pyrexia was unaccompanied by a marked rise in pulse-rate or by a leucocytosis. Following serum treatment there was a drop in both the red and white cell count; a blood transfusion was then given. The red cell count rose but the white cell count continued to fall, many primitive granular forms appeared and finally a blood-count showed practically no granular cells at all. Treatment with pentnucleotide produced an almost normal blood picture once more but the pyrexia persisted. Following an X-ray treatment to the bone marrow malaria parasites were found for the first time on the thirty-third day of the patient's illness despite almost daily examinations of the blood. Quinine was then administered and the pyrexia rapidly subsided. On the twelfth day of his illness the Wassermann reaction was positive, one week later it was strongly positive, and one week later again negative. The spleen was not palpable at any stage of the illness.

This case presented several interesting problems. A transitory positive Wassermann is known to occur in certain fevers and can be ignored in this case; the Kahn test remained negative throughout. Agranulocytosis is a disease characterized by a reduction in the white cell count, the granulocytes being specially affected. This is accompanied by a lowering of the powers of resistance, an acute febrile illness, and usually by ulcerative lesions most frequently in the mouth. It occurs usually in middle-aged women. One type has been described in which ulcerative lesions are absent and only moderate inflammation of the fauces is found. Very satisfactory results have been reported by some workers from treatment with pentnucleotide, the improvement in the blood picture becoming evident between the third and fifth days of treatment, and the mortality has been considerably reduced. This case was complicated by the persistent pyrexia, the finding of malaria parasites, and an instant response to quinine.

The questions to be answered in this case are:—

(1) Was a condition of agranulocytosis secondary to malaria?

(2) Was a condition of agranulocytosis secondary to a streptococcal septicæmia, a latent malaria being brought to light by the lowered resistance?

(3) Was this a primary agranulocytosis, the lowered resistance permitting an invasion of the blood-stream by the streptococcus in the throat and also revealing a latent malaria?

We suggest the following as a possible explanation of the sequence of events:—

A case of primary agranulocytosis, with mild inflammation of the throat and pyrexia, resulting in a lowered resistance and invasion of the blood-

stream by the streptococcus from the throat. A satisfactory response to treatment followed the revelation of a latent malaria resulting from X-ray stimulation of the bone marrow, which was finally cured by quinine.

This suggested course of events is based on the following points :—

The blood culture was sterile on admission, being positive two days later; the white cell count, which was always low, fell rapidly after a blood transfusion, the granular cells then responded well to treatment and the swing of the temperature was slightly lowered; following X-ray stimulation to the bone marrow the temperature swing was again increased, malaria parasites were found for the first time, and the pyrexia subsided completely on treatment with quinine.

Smith [1] has recently published a case of agranulocytosis and enumerated ten other cases published in this country. Fisher [2] has also recently recorded two cases and Hall [3] four cases; a total of seventeen cases. Plum [4], from the Blegdamshospital, Copenhagen, published seven cases in which agranulocytosis developed after therapeutic doses of amidopyrin and enumerated a total of 128 cases of a like nature from the literature since May, 1933, seventy of which were fatal. He states that since this effect of amidopyrin has been recognized it has been possible to ascertain that the patients were taking amidopyrin in the period immediately before the onset of the disease in a large majority of cases, and that this has in fact been ascertained in all the cases published in Denmark. We were unable to obtain any history of our case having taken amidopyrin (trade name pyramidon).

We are indebted to Colonel W. Benson, D.S.O., Officer Commanding the Queen Alexandra Military Hospital, for permission to forward these notes for publication; to Colonel J. Heatley Spencer, for his assistance with the case; to Major H. E. Yorke, M.C., for the particulars of the X-ray treatment; and to Captain E. H. Hall, for the very considerable amount of laboratory work that this case entailed.

REFERENCES.

[1] Smith, E. J. *Lancet*, 1934, ii, 1219.
[2] Fisher, J. H. *Ibid.*, 1934, ii, 1217.
[3] Hall, D. *Ibid.*, 1934, ii, 1441.
[4] Plum, P. *Ibid.*, 1935, i, 14.

Travel.

FROM SINGAPORE TO NORTH CHINA AND JAPAN.

By Major J. R. HAYMAN,
Royal Army Medical Corps.

(*Continued from p.* 62.)

We returned to the hotel for lunch, and afterwards hired a car to take us round the Summer Palace, Jade Fountain Temples, and the Western Hills, a circuit of some forty miles to the west of the Tartar City. We left the city by the north-west gate, and then proceeded along a dusty, narrow, ill-paved road which the R.A.C. would describe as third or fourth class. On either side the land is extensively tilled, mostly for garden produce. The Chinese are recognized as adepts at this form of cultivation. We passed through a number of small Chinese villages, which are really aggregations of mud huts. On two occasions we were stopped to pay car tax for the maintenance of the road, and it did *not* seem strange that we never saw any attempt being made to level or repair the road itself.

The Summer Palace lies about eight miles from the city. Like the Winter Palace, it consists of a number of pavilions dotted about on a hill rising some 300 feet, in front of which is an artificial lake. Only, in the case of the Summer Palace, the hill, buildings and lake are on a much larger scale. The base of the hill must have a circumference of some five miles.

A local guide pestered us by offering his services. Somehow, we preferred to explore the place alone with the help of a coloured contour map, rather than listen to a monotonous repetition of facts, figures and dates. On the northern slopes is a mass of ruined buildings and temples. Truly a devastated city!

These ruins are the remains of the old palace which was destroyed and looted by order of the British Commander of the Allied British and French Force in the Chinese War of 1860 as a reprisal for the brutal ill-treatment and massacre of European prisoners and civilians. The ruins cover a fairly extensive area and it was not too easy to get one's bearings, so we rather regretted not having made use of the guide. We retraced our steps and then walked along the crest of the hill to descend down the further slopes. We passed along numerous covered pathways and small pavilions until we reached the front of the lake. Here the gardens and covered walks are laid out in a very picturesque manner. On the far side was anchored the famous Marble Boat.

It is a two decker, stately, and very ornate barge, marble in parts, the remainder being made of painted wood. From a distance it is quite an imposing object and was used for Royal functions. Looking across the lake one sees a very pretty little island connected to the mainland by the many-spanned Marble Bridge.

To the right is another very picturesque bridge which from its design is known as the Camel's Back Bridge. On the southern aspect of the Palace Hill are two very fine buildings, one of which is situated near the crest, and is known as the Temple of the Five Thousand Buddhas, and the other, standing near-by, is known as the Temple of the Clouds. Nowadays the Summer Palace is unoccupied except by the caretakers. There were a fair number of Chinese soldiers meandering about, but they did not appear to have any particular object in life. For some years after the Palace Buildings had been laid waste in 1860 the place had remained vacant. Then the late Dowager Empress thought it would be a good thing to reconstruct the buildings and use the place as a summer residence again. For this purpose, she very cleverly misappropriated a huge sum of public money which had been collected for the purpose of building a Chinese Navy. An American writer described the incident as "a woman's $5,000,000 whim." In any case, the old lady might have shrewdly suspected that the proposed Chinese Navy would be a futile force, and might act rather as an internal danger than as an external defence. Still there must have been some misgivings in the war of 1894 when the Chinese were defeated by the Japanese.

FIG. 8.—The Marble Boat anchored near the Summer Palace.

We left the Summer Palace, and continued along the fringe of the Western Hills for some ten miles until we reached the Jade Fountain Park. A local guide came forward to offer his services, and on this

occasion we were glad to accept them. He first took us up the steep sides of a cliff and showed us some small Buddhist grotto shrines which failed to impress us much. He next wanted us to climb to the top of the hill to see a high stone pagoda built on the crest. It was a hot thirsty afternoon, and we were content to admire this structure at a distance. So we asked him to lead us on to the Jade Fountain. On we trudged, full of hope at the expected sight. Finally we descended the cliffs and came upon a small shallow pond. "The Jade Fountain" said our guide. Well, the water at least was cool, clear and inviting, and would have made a nice bathing pool. On one side is a moderate-sized spring, and at the bottom of the pond is a green sediment which accounts for the name. The small stream supplies the water for the artificial lakes.

We then left the Jade Fountain Park and continued the journey for

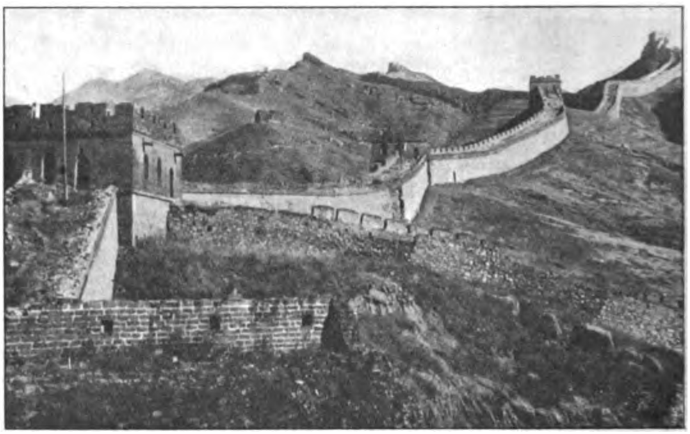


FIG. 9.—A section of the Great Wall.

some miles until we reached the Western Hills Hotel, where we were glad to refresh ourselves. The hotel itself must have been an ambitious scheme, but appeared to be suffering at the time from the world-wide depression. Dotted among the Western Hills are numerous shrines and temples, ancient and modern. Some of these are rented to foreigners for the hot season, and here they can enjoy pleasant walks and a relatively invigorating atmosphere, compared to the hot stagnant and dust-laden air of the city.

At one period tigers roamed over the Western Hills and provided sport for the Royal households. After having had some tea, we left the hotel, and then took the southern road back to Pekin. The scenery differed little from that first described. The road-surface, if anything, was rather worse. The driver had to slow down repeatedly to cross culverts, or avoid pot holes. So we arrived back at the Hotel du Nord, weary, dusty and somewhat shaken.

A tour that we particularly wished to make was a visit to the Great Wall, or rather the Southern Section of the Great Wall. In the same area are the famous Ming Tombs, the burial places of the Ming Emperors. The distance is rather less than a hundred miles north of Pekin, and can be reached by either rail or car, but better still by a combination of both.

Unfortunately travelling at that time was rather precarious, and in addition our time was short. Also the Japanese had begun to send aeroplanes over Pekin, though only to drop pamphlets, and the aeroplanes had been fired on by the Chinese troops. Altogether the situation was becoming critical.

The following day we visited the Temple of Heaven, an extensive

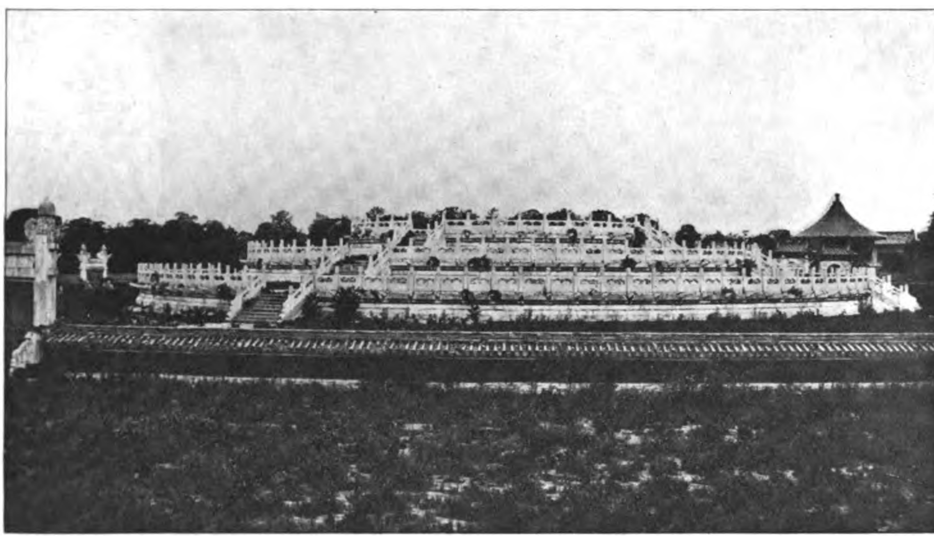


FIG. 10.—The Altar of Heaven.

enclosed area lying on the southern side of the Chinese city. The rickshaw drive was a long tedious affair, through congested, ill-paved streets and alley-ways. We were thankful to reach the entrance gates at last. Here the ubiquitous local guide was waiting to offer his services, and in this instance there was little alternative but to accept. He was a keen fellow and anxious that we should see and understand everything. If we asked a question he would advance closely, so closely, in fact, that the smell of garlic or whatever it was, was almost asphyxiating, so we quickly learnt to accept his statements without comment.

THE TEMPLE OF HEAVEN GROUNDS.

The park in which the Temple of Heaven is situated is very extensive and contains avenues flanked with cedars. Some of these trees are reputed to be nearly a thousand years old, but if that is the case, either the

soil or the climate must be against them, for they are neither tall nor imposing. The Temple of Heaven buildings occupy a relatively small area and extend in a north and south direction, located approximately in the middle of the park grounds. At the southern point is a circular marble

FIG. 11.—Marble stairway of Hu'ang Chun Yu.

edifice built in three terraces, rising some eighteen feet above ground level, and having a diameter of about fifty feet. This is the Altar of Heaven. It had been the custom for some 4,000 years, so we are told, for the Emperor to make obeisance and offer up prayers for the people to the "One Supreme Being," twice yearly. And here the Emperor

with his numerous retinue came from his palace three miles distant. According to a writer's description it was a magnificent pageant, while the form of ritualism accorded by tradition involved a considerable amount of preparation, training and experience. The Altar is constructed with

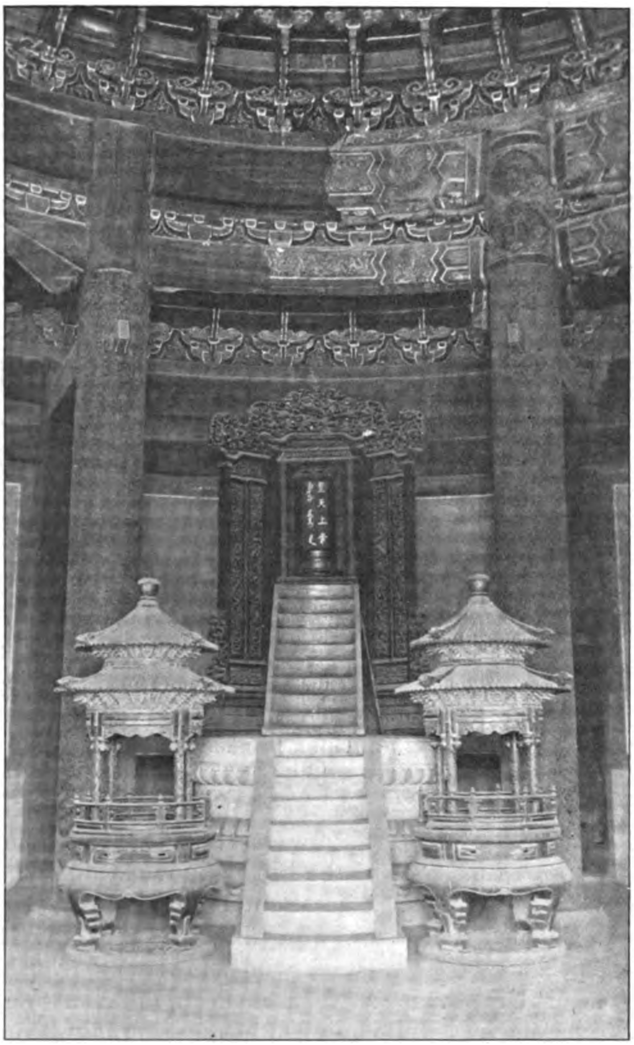


Fig. 12.—The Tablet of Heaven.

geometrical precision, in which the predominant factor is the numeral 9, the Chinese lucky number.

Each terrace is approached by nine steps, and the upper terrace is paved with nine concentric circles of marble. At a distance of a stone's throw, is an incinerator-like structure standing some nine feet high. This was

used for animal sacrifice, when a "bull-calf of unmixed colour and without flaw" was the unfortunate victim. To the left of this structure are eight openwork metal braziers which were used for burning rolls of silk, and prayers written on silk during the sacrificial celebrations.

Leaving the Altar of Heaven and proceeding in a northerly direction we came to a circular walled-in enclosure. Standing in the centre of the enclosure, one's voice gives a distinct echo. Our guide was very insistent that we should thoroughly appreciate this phenomenon. For some reason a guide always seems happy if he can produce an echo. But, in this instance, it appears that the Emperor utilized the idea as a form of oracular demonstration. Beyond the enclosure is an elevated causeway extending a quarter of a mile. Walking along this causeway we approached two buildings. The first is the Temple of the Happy New Year. The blue-tiled triple roof rises ninety-nine feet. Here, the ancestral tablets were kept, and here again the Emperor used to come in the springtime to make offerings for a propitious harvest. Beyond the Temple of the Happy New Year is the Temple of Agriculture, a similar but smaller structure. This contained the Tablet of Shen Nang, a prehistoric Emperor known as the First Farmer, who was supposed to have lived about 3,000 B.C. The Emperor and his retinue came once a year to pay his respects to the Tablet. This completed our tour of the Temple of Heaven and we retraced our steps along the cedar-tree avenues towards the entrance gate. We then went back to the Tartar City by the Chien Men Street.

The entrance into the Tartar City is by way of the Chien Men Gate, or Gate of Prosperity. The original gateway was burnt down during the Boxer riots in 1900, and was afterwards rebuilt. Passing through the gateway we turned to the right and entered the American Legation Area. The quiet orderliness of this Quarter formed a marvellous contrast to the noisome slums just outside. The American Legation has a large and effective radio station, the tall masts of which assist the tourist as a landmark.

The next morning (May 14) we met Miss Punnett who is connected with the well-known local firm of Punnett and Co., carpet manufacturers; she very kindly showed us some of the better-known Chinese shops selling porcelain and such like articles. Miss Punnett then took us to the Peiping Union Medical College, where we were introduced to Dr. Maxwell, the gynæcological specialist on the staff, who showed us over the hospital buildings. The P.U.M.C. is a very modern, efficient and complete unit. Apart from the very well-equipped hospital buildings, it has its own college, teaching staff and research department. It was founded in 1906 by various Protestant Missionary Societies. In 1915, its maintenance was taken over by the Rockefeller Foundation, and no expense seems to have been spared to make it thoroughly up to date. Speaking of missions, it is said that there are seventy-seven different missionary societies operating in China, and that they expend over £3,000,000 sterling annually in connection with their work.

In the afternoon we caught the 4.30 p.m. train back to Tientsin.

While I was in Pekin, I had expected to see evidence of many battle casualties since China had been undergoing civil war, and war against the Japanese, for at least two years.

Actually I only saw one Chinese soldier with any sign of a disability, and he had one arm bandaged.

And this reminds me of a passage I read in a book on China, Korea and Japan, written by the late Lord Curzon, in which he mentions that one of the ancient rules of strategy in warfare recommended by the early Chinese military authorities was as follows:—

"If the enemy threatens to attack, send an orchestra into his camp to play soothing music which might soften his heart."

(*To be continued.*)

Current Literature.

Seymour, F. R. **A Note on the System of Public Water Supply in Bermuda.** *The Medical Officer*, 1934, v. 52, No. 19.

This account of the first and only system of public water supply in Bermuda is published by permission of His Excellency The Governor. Its chief interest lies in the fact that it tends to alter the current ideas as to what is required to support the layer of underground water usually tapped by shallow wells. Writers in general describe this as being done by the first impermeable stratum which the water reaches in its downward passage through the soil. It has been found, however, that a solid stratum is not always necessary and that, under conditions such as exist in Bermuda, the subsoil water may be supported by a layer of salt water.

The islands consist of a coral formation resting on a deep volcanic base and the porous limestone takes up sea water like a sponge. There are no rivers, streams or springs and wells are few and of limited capacity. The rainfall, however, is usually plentiful and this has in the past been collected from prepared areas for the supply of the inhabitants.

With the increase of the resident population and the very great influx of visitors the need for additional supplies became urgent, and the Watlington Waterworks for the supply of the town of Hamilton and houses in its immediate vicinity are the result of this demand.

The system of supply adopted in these works is based on the fact that rain falling on a hill consisting of porous material soaks downwards until it meets some obstacle, which in this case is provided by the sea water which permeates the base of the hill, and that a cushion of fresh water then forms on the heavier sea water, depresses the level of the latter and is separated from it by a thin layer of brackish water formed by the mixing of a small amount of rain and sea water.

Rain water thus prevented from travelling further in a downward direction tends to escape laterally, causing a flow from the centre of the hill towards the sides. The level of the ground water tends to conform to the surface contour, being highest about the middle of the hill and since the water cushion is thus thickest and heaviest in the middle it is here that the salt water is most depressed and the cushion assumes the shape of a double convex lens.

Similar supplies have previously been tapped in Long Island, New York, in North Holland and in the Bahamas and may be reached by means of perpendicular wells, horizontal adits driven towards the middle of the hill or by collecting galleries or trenches cut along the contour near the foot. Where adits or galleries are used they must be cut at such a level as will skim off the greatest amount of fresh water without causing undue risk of taking brackish water. This may sometimes be difficult because it has been found that the withdrawal of fresh water does not immediately lower the top level of the fresh water cushion, but instead, by lessening the weight of the fresh water, tends to allow the sea water to rise.

The arrangements in Bermuda provide for a supply of about 220 gallons per minute. The water after its passage through the limestone is naturally hard and undergoes a softening process and chlorination before being admitted to the service reservoir.

KARSTEN AND BISCHOFF. Die Feststellung der Abortus-Bang-Infektion des Rindes durch die Untersuchung der Milch. [**The Diagnosis of Abortus Infection in Cows by Examination of the Milk.**] *Deut. Tierärzt. Woch.* 1934, v. 42, 465-9.

This is a valuable article analysing the results of different methods of examination of the blood serum and milk of cows for evidence of infection with *Br. abortus.*

For demonstrating the infectivity of the milk the guinea-pig test is still the most valuable. The inoculum should consist of a mixture of gravity cream and the deposit of centrifuged skim milk, though almost equally good results are obtained by the use of four cubic centimetres of whole milk. Two animals should be inoculated subcutaneously into the thigh. After three and six weeks blood should be withdrawn from the heart, and examined for antibodies. An agglutinin titre of 1 : 40 or over, or a complement-fixing antibody titre of 0·02, should be regarded as positive. If the results are negative, the animals should be killed after two months, the blood again examined for antibodies and cultures made from the glands and spleen. Agglutinins are usually demonstrable in the guinea-pig's serum earlier than complement-fixing antibodies. Agglutinins, for example, often appear in two to three weeks, while complement-fixing antibodies do not appear for four to six weeks. Rats and mice have been found less suitable than guinea-pigs ; agglutinins are formed poorly and irregularly, and the mouse, at any rate, appears to be more resistant to *abortus* infection than the guinea-pig.

The cultural method is less satisfactory and should be attempted only with milk from single cows—preferably with individual quarter samples. During transit the milk may be preserved with 0·5 to 0·75 per cent boric acid. Gravity cream should be examined whenever possible; if not, whole milk or the centrifuged deposit should be used for inoculation of the plates. The medium recommended is 3 per cent glycerine agar containing 10 to 15 per cent of ox or horse serum. If the milk has not been withdrawn very carefully, 0·4 to 0·6 cubic centimetre of a 1 per cent solution of gentian violet and the same quantity of a 1 per cent solution of malachite green should be added per litre. The plates should be incubated in 10 per cent CO_2, and examined after four and seven days for the characteristic colonies. If the plates are further left at room temperature for a day or so, the colour of the *abortus* colonies becomes deeper than that of the medium itself and than that of the other colonies, and they take on a peculiar sheen. Generally speaking, the cultural method is only about half as delicate as the guinea-pig method. Of 466 milks examined by both methods, 184 proved positive by the guinea-pig and 101 by the cultural method. Only three milks were positive culturally that were negative by animal inoculation.

An agglutinin titre of 1 : 10 in the milk serum of individual cows is regarded as definite evidence of infection, and a titre of 1 : 40 indicates that *Br. abortus* is probably being excreted in the milk. Besides the agglutination test on the milk-serum, the complement-fixation test may be carried out. Very favourable results have been obtained by this test, and still more by the use of both tests, since some milks are shown to be positive by one and some by the other test. Thus of 631 individual cow and separate quarter samples 308 were positive and 72 negative by both tests; of the remaining 251 samples, 98 gave a positive agglutination and 153 a positive complement-fixation reaction. The value of performing both tests is further illustrated by the following figures. Of 247 individual cow and separate quarter samples in which *Br. abortus* was proved to be present by the guinea-pig test, 174 (70·4 per cent) gave a positive agglutination, 180 (72·9 per cent) a positive complement-fixation, and 235 (95·1 per cent) either a positive agglutination or a positive complement-fixation reaction. The complement-fixation test should be carried out with 0·1 and 0·3 cubic centimetre of milk serum. Fixation with 0·3 cubic centimetre is regarded as a positive reaction and fixation with 0·05 cubic centimetre as strongly indicative that *abortus* bacilli are being excreted in the milk. The completion-fixation reaction tends to be more constant and to remain positive for a longer time than the agglutination reaction, and to yield more trustworthy results with colostrum. Some milk sera, however, are unsuitable on account of turbidity or spontaneous fixation. About 5 per cent of milks shown to contain *Br. abortus* by guinea-pig inoculation prove negative both by agglutination and complement-fixation tests.

The agglutination test on the milk-serum gives 10 to 20 per cent fewer

positive results than on the blood-serum, while the complement-fixation test on the milk-serum tends to give results more nearly approaching those on the blood-serum. For the diagnosis of infection blood-serum is definitely more suitable than milk-serum, as the following figures, carried out on a series of 900 infected cows, show :—

Blood-serum: positive by agglutination or cerebrospinal fluid reaction 866 (96·2 per cent) of cows. Blood-serum positive by agglutination alone 841 (93·4 per cent) of cows. Blood-serum positive by cerebrospinal fluid alone 795 (88·3 per cent) of cows.

Milk-serum: positive by agglutination or cerebrospinal fluid reaction 747 (83·0 per cent) of cows. Milk-serum positive by agglutination alone 560 (62·2 per cent) of cows. Milk-serum positive by cerebrospinal fluid alone 650 (72·3 per cent) of cows.

For practical purposes no milk can be guaranteed as being free from *abortus* bacilli unless the whole herd is free from infection.

G. S. WILSON.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 11.

Reviews.

LECTURES ON MEDICAL ELECTRICITY. By Elkin P. Cumberbatch, M.A., B.M.(Oxon.), D.M.R.E.(Camb.), F.R.C.P. London: Henry Kimpton. 1934. Pp. viii + 236. 38 illustrations. Price 6s. net.

When it is realized that the popular work on "Essentials of Medical Electricity" by the same author has now reached its seventh edition, anything on the subject written by him must be regarded as an important contribution to the subject.

Nor are we disappointed. The present volume will be of the greatest assistance to those who have to give instruction in the subject.

It consists of a series of lectures in the simplest language, and a striking feature is the suggested notes on the lectures that the student should write down himself. At the end of each chapter the practical demonstrations to illustrate the lecture are detailed.

The whole field of medical electricity is covered and great care is taken not to exaggerate the claims of those diseases which can be treated by electrical methods; sound advice is given as to its real scope.

It is a very pleasant book to read and forms a good companion volume to the author's "Essentials of Medical Electricity."

The book is excellently produced, adequately illustrated and indexed, and can be warmly recommended to all interested in this subject, and especially to those who are engaged in teaching and to their students.

J. W. W.

SURGICAL APPLIED ANATOMY. By Sir Frederick Treves, Bart. Ninth Edition, revised by C. C. Choyce, C.M.G., C.B.E., F.R.C.S. London: Cassell and Company. 1934. Pp. 720. Price 14s.

The ninth edition of this well-known work has been completely revised by Professor C. C. Choyce. Fifty years have elapsed since the first edition was published and during this period the practice of surgery has undergone many changes, with the result that much of what appeared in the earlier editions is now only of historical interest.

In the work of revision Professor Choyce has been most judicious in his selection of what to retain and what to delete, and he must be congratulated on the fact that although the work is now thoroughly up-to-date it nevertheless still retains that original style and character which in the past made it so popular.

The book is clearly printed and the illustrations, which have been increased to 174, including 66 in colour, have been well produced.

The work can be confidently recommended to students preparing for their final examination and to others who wish to revise those anatomical facts which have a direct bearing on the practice of surgery.

D. McK.

NEPHRITIS AND ALLIED DISEASES: THEIR PATHOLOGY AND TREATMENT. By Robert Platt, M.D.Sheff., M.R.C.P.Lond.. Oxford University Press. London: Humphrey Milford. 1934. Pp. xi + 166. Price 7s. 6d.

Dr. Platt's Nephritis and Allied Diseases give a clear picture of the main features of this group of diseases. At the beginning a short account of the anatomy and physiology of the kidney is given and the theories of œdema are discussed; this is followed by a valuable chapter on the tests of renal function, area concentration of McLean, dilution and concentration test of Volhard, and urea clearance of Möller, McIntosh and Van Slyke.

The clinical aspect of the disease is dealt with in a full and practical manner, and the treatment advised in the various types of nephritis is very adequately described.

In Chapter XIII, Dr. Platt discusses the question of albuminuria without nephritis and emphasizes the importance of remembering that while albuminuria as a sole manifestation of renal disease is rare, it is not infrequently present in febrile or toxic conditions, with the congestion of heart failure, and following the administration of drugs, including aspirin and salicylates.

The final chapter gives a short description of the methods of blood and urine examination.

The book is one that can be confidently recommended to anyone desirous of having a reliable book of reference on this subject.

A HANDBOOK ON DIABETES MELLITUS AND ITS MODERN TREATMENT. By J. P. Bose, M.B.(Cal.), F.C.S.(Lond.). Calcutta: Thacker, Spink and Co. (1933), Ltd. 1934. Pp. xviii + 232. Rs. 6·8.

The second edition of this little book appears six years after the original. Dr. Bose treats the subject in a very thorough manner. There are chapters on diagnosis, blood sugar estimations and their interpretation, and on the complications of the disease.

The use of insulin is thoroughly discussed and rules given for estimating the amounts required. A section of the book deals with the disease in childhood. A large appendix containing all the tables of food values, etc., necessary in such a work completes what we consider a very useful book for students and practitioners. J. H.-S.

THE MEDICAL ANNUAL, 1934. Bristol: John Wright & Sons, Ltd. Price 20s. net.

The Medical Annual for 1934 maintains its usual high standard as a valuable summary of current medical literature. Its editors can justifiably claim that no new method of treatment which has been discovered or improved during the past year is ignored.

There are many articles on surgical subjects which will interest both the surgeon and the non-specialist. Some of these are such interesting expositions of surgical theory and practice that one is tempted to read on and on.

There are articles on such diverse topics as the X-ray diagnosis of intestinal obstruction by demonstrating gas patterns and horizontal fluid levels; a new treatment for nocturnal enuresis by perineal injection of normal saline; the advisability of waiting for encapsulation before operating on abscess of the brain; the treatment of tennis elbow; the Winnett-Orr method of treating open fractures; and the advantage of injecting a spinal anæsthetic extradurally instead of into the theca for operations on the upper abdomen.

There is an interesting article on agranulocytic angina with the results obtained from pentose nucleotide K.G.96 administration. The anæmias on which so much valuable work has been carried out during recent years are reviewed and a most valuable summary of the whole subject is set out, including both the anæmias of adults and childhood. Treatment is also fully dealt with and the advantages of the parenteral method of administration of liver preparations in pernicious anæmia is emphasized figures are given indicating the essential need for treatment of this disease based on regular blood examinations.

A clear account is given of congenital cerebral aneurisms and the symptoms associated with the not uncommon spontaneous subarachnoid hæmorrhage; the pathogenesis and the lines of treatment are discussed.

A useful summary of the recent important work on cysticercosis appears. The subject of gastric and duodenal ulceration is considered fully, also the problem of hæmatemesis.

There is a valuable article on insomnia and hypnotic drugs, indicating the necessity for searching for and removing the cause of the complaint before instituting treatment; this is then fully discussed. Stammering, which can be such a trying disability to a child at school and such a serious handicap in adult life, is dealt with and the method of treatment set forth.

The current volume can be confidently recommended as an authoritative work of reference which contains an enormous amount of information in a small space.

HEAD INJURIES. By L. Bathe Rawling, M.B., B.Ch.Cantab., F.R.C.S. Oxford University Press. London: Humphrey Milford. 1934. Pp. 86. Price 7s. 6d. net.

This is a somewhat elementary little book of 86 pages with 22 well reproduced semi-diagrammatic illustrations. In the preface the author describes it as "a book of personal experience, based on the interest of a lifetime—written in concise and dogmatic manner, but for those who will appreciate clinical facts apart from too much theory." Obviously not written for surgeons of experience in the treatment of head injuries, it can, however, be recommended to those on the threshold of experience as a succinct account of diagnosis and general lines in treatment. The author's remarks on lumbar puncture in diagnosis and treatment are especially useful, and the fact that such cases, after they have recovered from the initial shock, should be nursed "well propped up by pillows" is an instruction that appears to require more repetition than many would credit. "Written in the Balearic Isles, away from all references," one is left admiring the industry of the writer, and respecting his opinions.

D. C. M.

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Original Communications.

THE FIFTEENTH INTERNATIONAL RED CROSS CONFERENCE AT TOKYO, OCTOBER 20—29, 1934.[1]

BY LIEUTENANT-GENERAL SIR HAROLD FAWCUS, K.C.B., C.M.G., D.S.O.

(Director General, British Red Cross Society).

NEVER again, in moments of depression, shall I be tempted to think that the crudeness and cruelty of human discord can ever totally displace the good that is inherent in mankind. For I have just experienced such a remarkable manifestation of international goodwill that I am convinced its benign influence need never pass away.

I have attended the Fifteenth International Red Cross Conference at Tokyo, held from October 20 to 29, 1934. Among the kaleidoscopic memories of the whole trip across the Pacific, via Honolulu, to Japan, and the return journey through the States, the outstanding impression remains of the hospitality and real gratitude expressed by the East for the West. The Red Cross extended a helping hand to Japan in her hour of need—after the earthquake in 1923—and never again can it be said "East is East, and West is West, and never the twain shall meet." For gratitude has spanned the differences of race and creed, and the needs of our common humanity, which the Red Cross stands to fulfil, unite the nations of the world and sweeten human intercourse. Unselfish effort to further the ideals of the Red Cross to alleviate misery counteracts national misunderstandings in a more effective way than any other conferences have hitherto done.

[1] Reprinted from *The British Red Cross Quarterly Review*, January, 1935.

Leaving London on August 25, I arrived at Quebec on August 30. In Canada, I visited Montreal, Ottawa, and Toronto. In Toronto, I spent my time at the Canadian Red Cross Headquarters, and learnt about their activities. Their hospitality is proverbial, especially to those from the Mother Country. I found the Canadians intensely loyal, and proud of being British. The vastness and enormous distances of their magnificent country impressed me very much. The cities are beautifully laid out, with some wonderful buildings and many lovely parks. It is difficult to realize that Canada is almost 4,000 miles from shore to shore, and that only a strip from east to west is inhabited.

Leaving Toronto and my good Canadian friends, I spent three days at Washington as the guest of the American Red Cross Society. I went over their beautiful building near the White House, and visited every Department of their Headquarters. During that time I was introduced to each member of their Central Committee. The officials were kindness itself, and were obviously delighted to have a visitor from Great Britain. Judge Payne (President of the American Red Cross and of the League of Red Cross Societies) entertained me at his week-end house in the Warrenton Woods, overlooking his cattle farm in the valley, and gave me a vivid word picture from memory of Stonewall Jackson's campaign in that area. Though 85 years of age, the Judge painted the picture of the battle as vividly as if it were before his eyes, pointing out to me the landmarks in the scenery spread out before us in the valley. He also told me the whole history of the League of Red Cross Societies, and of the International Committee. By far the largest American Red Cross activity is Disaster Relief; war is so far from its zones that not much attention is given to it. When mentioning war the reference is usually to the Civil War between North and South, which still lives in the memory of the older men.

At a lunch at the Army and Navy Club, I was introduced to the Deans of all the Medical Universities, as well as the Red Cross Directors, and Senior Officers of the Army Medical Corps. I was sorry to say good-bye to such kind hosts, when I left for Vancouver, via Chicago. After a day at Chicago, we were two days crossing the prairies, which stretch for miles, in colour and undulation like the Sahara, and I was not sorry to arrive at Banff, at the entrance to the Rockies, on September 20.

The hills and valleys were white with snow. All day I sat in the observation car, and as other pens have described the awe-inspiring magnificence of these lofty peaks, I will only mention that I preferred the descent to the ascent. Snow-capped summits, steel-green firs, ice-blue rivers, cascading down the mountains like snowy folds of muslin veils and tearing through canyons, remain an unforgettable memory.

At Vancouver, having completed a train journey of some 3,300 miles, I embarked on the "Empress of Canada," which was very full of passengers, including several U.S.A. delegates to the Conference. On hearing of the

typhoon disaster, I sent a cable to Prince Iyesato-Tokugawa, President of the Japanese Red Cross, expressing the sympathy of the British Delegation, and received an answer, wishing us " a peaceful voyage, and a safe arrival." On board, I soon got to know the other delegates from the U.S.A. and Czecho-Slovakia.

During the time that the ship remained at Honolulu, I was met by the Honolulu Chapter of the American Red Cross officials, and shown over the island. It is a veritable paradise of palm trees, gaudy flowers, sunshine and blue sky—the wonderful colour of the fruits and foliage beggars description. In moonlight it is even more beautiful. We were seen off by a crowd of people, who, as at our arrival, hung "leis" (flower garlands) round our necks. Native boys swam round the ship, climbed on board, and dived from our top deck for coins.

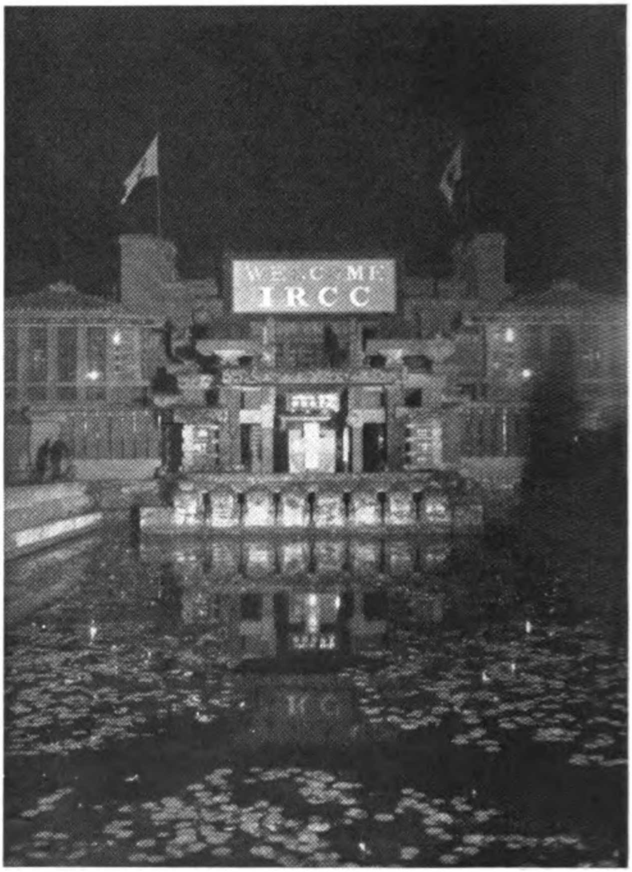
Crossing the meridian on October 1 (which we skipped from our calendar), we arrived on October 6 at Yokohama. A great crowd, including Prince Tokugawa, and all the leading officials of the Japanese Red Cross, was on the wharf to meet us, the royal waiting-room at the docks being opened specially for our use.

From there we went to the Imperial Hotel, Tokyo, where most of the delegates to the Conference were staying. At the entrance, gay little Japanese waitresses stood beneath a placard inscribed, " Welcome, I.R.C.C.," and waved Red Cross flags.

The new Tokyo (built after the earthquake of 1923) is the world's third greatest city, exceeded in population only by New York and London. It assumed this position by absorbing five towns and eighty-two villages on October 1, 1932. It has electric trams, motor 'buses, and subways, and is constructed on western lines. What it has lost in artistic charm, it has gained in safety and efficiency. Parks and wide boulevards remove the hazards of the narrow areas of old Tokyo. The day after our arrival I visited Shiba Park, the Red Cross Headquarters, where the Conference was to be held. A new wing had been added to meet the needs of the secretariat. Later I paid official calls, includiug one on H.I.H. Prince Kan-in, Honorary President of the Japanese Red Cross.

While waiting for the opening of the International Congress, a party of us decided to see some of the famous spots near the capital. The Japanese Red Cross undertook the entire arrangements of our tour, meeting us at each place, and escorting us over the sights. From the train *en route* to Kyoto, we had a magnificent view of Mount Fujiyama. When first seen among the clouds, it is so like them as to be almost obscured, but as one continues gazing in the sky, there emerges the impression of a white cone, with nothing but clouds below it. As there is no snow anywhere else, an impression of mystery and almost supernatural aloofness is given, which makes the national veneration for the sacred mountain easily understood. Nowhere else in the world is there such a close relationship between a whole nation and a mountain. To the Japanese it is sublime, and is named " Mountain of Everlasting Life."

We made a tour in cars of Kyoto, visiting shrines, temples, and the places destroyed in the recent typhoon. Thence we went on to Osaka, where we climbed Osa Castle, and from its 300 foot tower had a fine view of the city. It is the Manchester of Japan—the centre of the cotton industry. The Red Cross had done fine relief work after the havoc wrought by the giant tidal wave, which inundated the town to a height of ten feet, causing much suffering and many deaths. We saw the wreckage of ships



Front of the Imperial Hotel, Tokyo. Welcome to Delegates.

piled up on the harbour shores, and then visited the newly-opened Red Cross Hospital, with its 1,800 beds, partly free and partly paying. Some of the rooms have kitchens and living-rooms for the families of the patients, who come to live near them. A very fine and spacious nurses' home and a training school adjoin it. Here we saw the probationers performing a strenuous drill, armed with sharp-pronged poles to teach them self-defence.

We also noticed that all school children marched in military formation, equipped with haversacks and water-bottles. Train-loads of them were to be seen escorted to the national shrines, to do reverence, typifying the spirit of the whole nation, which places Fatherland before every other consideration.

Our visit to the Osaka puppet show was unique. The next day we were taken to Nara, a former capital, and saw a large Shinto shrine in a huge park full of sacred deer, which came nosing into our hands for the biscuits visitors always bestow. The famous fifty foot Buddha is housed in a Nara temple; then we were shown the Horuji temples, full of priceless national treasures, and the shrines to the Buddhisattva of Compassion "Kwannon" — the sublime beneficence of whose expression is truly remarkable. One ebony statue of her belonged to a Buddhist nunnery, where we were invited to the traditional tea ceremony. We all knelt on the floor, shoes off, while the nuns, with shaven heads, handed us fragrant tea and delicate rice wafers.

Returning to Tokyo, the hotel was so overcrowded with delegates that I was glad to accept the kind invitation of the Canadian Minister and Mrs. Marler, to stay at the Embassy. The Minister placed the whole staff at my disposal, and his hospitality was most welcome.

Before the business of the International Conference was inaugurated, an opportunity was made to hold an informal meeting of the delegates from the British Empire, at the kind invitation of Mr. and Mrs. Marler. Several points of common interest were discussed, such as the collection of funds, the relationship between the Red Cross Societies and the Order of St. John, and the question of holding the next Empire Conference.

On October 16, we attended the opening of the National Convention of the Japan Red Cross Society, held in the picturesque Constitution Memorial Hall in the presence of the Empress.

Her Majesty is actively interested in the work, often visits headquarters, and donates an annual subscription from her private purse. We all stood on a platform in the park, facing a crowd of some 13,000. Shouts of "Banzai!" (hurrah!) arose as the Empress, beautifully dressed, proceeded to the white dais, followed by Princes and Princesses, and facing the loud speakers, read the brief message in a soft, clear voice.

She requested the Fifteenth International Red Cross Conference to promote "still further the enterprises of the Red Cross Society through co-operation, in order that it might meet the requirements of the time and contribute to the welfare of mankind."

Every head in the crowd was bowed at her entrance, bringing a sudden change of colour from the pink of upraised foreheads to the black of Japanese heads, like wind passing over a field of wheat! The Empress was the first to leave, no one else moving until the Imperial red limousine had taken her back to the Palace.

The next day a meeting of the Executive Committee of the League of

Red Cross Societies, with Judge Payne presiding, took place at Shiba Park ; and on the 18th, a noteworthy event was the adoption of a resolution at a meeting of the Board of Governors, inviting the alliance of the Red Cross and Crescent Societies of the Union of Soviet Socialist Republics to the League, thus bringing the total membership to sixty-one. Prince Tokugawa was then unanimously elected President of the International Conference, and the head of the Spanish delegation gave an invitation for the next meeting to be held at Madrid. This was accepted with acclamation.

That evening a reception was held by Prince Tokugawa at the Peers' Club, when the delegates were entertained by a "Nō" drama. These

Executive Committee of the League of Red Cross Societies, at Tokyo. Judge Barton Payne presiding.

sacred dances, first performed more than ten centuries ago, were part of the Shinto ritual at the Court on festival days. The music (played on ancient pipes) is weird ; each character chants his or her speech as in opera. I was told that no Japanese can now understand the words.

On October 20, in the presence of Prince Kan-in, the opening session of the Conference took place, the ceremonies being broadcast throughout the Japanese Empire. Prince Tokugawa delivered an address of welcome to the delegates, who represented fifty-seven nations. The U.S.A. delegation alone consisted of seventy-eight members, a fact which caused Judge Payne to cable from on board ship to Prince Tokugawa as follows: "I am approaching the shores of Japan at the head of seventy-eight American delegates, but please do not think it necessary to call out the army!"

Some twenty Vice-Presidents were appointed, who were generally the heads of the various delegations.

The first business on the agenda was the report of the International Committee of Geneva. Regret was expressed at the absence through illness of M. Huber, the President. After this meeting it was announced that the Empress of Japan would donate the sum of 100,000 yen to the International Committee.

From that stage the Conference split up into various commissions. One of the most stirring events of the entire Conference occurred in Commission 2, when M. Christian Rakowsky, the Soviet delegate, delivered an impassioned speech on the duty of the Red Cross to make every effort to prevent war. He introduced a resolution to the effect that the Red Cross Societies should bring pressure to bear on their governments to make legal rules prohibiting war. In opposing the motion, I said that the making of war and the maintenance of peace was a matter for governments and not for the Red Cross, and that if the wording of the resolution were amended to express the earnest hope that the Red Cross would do its utmost to prevent war, more was unnecessary, as such was already its activity. After discussion, the resolution was carried that "the Red Cross, without losing sight of its usual wartime and peacetime activities, must exert every effort within the sphere of its attributions to prevent war."

A second feature was the proposal by the Mexican delegate that in order to express the gratitude of the various delegations to their Japanese hosts the delegates should contribute for the relief of the sufferers in the recent typhoon.

Later, women delegates were entertained at tea at the palace of Princess Kan-in, while the Premier Keisuke Okada and members of the Cabinet welcomed the leaders of the Societies to a banquet, and held a reception afterwards in a lantern-lit garden.

At the meetings every speech was translated from English into French, and vice versa. The Plenary Sessions of the Conference took place four times. The Executive met once, the Board of Governors twice. The business was concerned with the work of the Conference only, the rest of the work being done in the Commissions, which framed resolutions on every subject for the approval of the Plenary Session. Most of these were in the form of a hope that the Red Cross Societies would continue the active work in which they were already engaged, and some stressed the lack of financial support. One outstanding report was given very lucidly by Miss Norah Hill on Disaster Relief in the Bihar earthquake in India. She said that the Indian Red Cross was started in 1920, and its chief problem was the training of Indian women, for they did not like working outside their homes. She expressed appreciation for the gift of £1,000 to the Indian Red Cross, received by the Indian Government from the Internation a Relief Union.

A garden party was given by Baron Iwasaki, and a gala performance

at the Kabuki theatre, where the actors are all men, the one who took the part of a maiden being 64 years old.

On October 24 the heads of delegations were presented to the Emperor and Empress at the Imperial Palace, the front of which resembles Buckingham Palace.

The Empress is very dignified and stately, and spoke no word. Afterwards we saw some of the royal rooms, which are artistically decorated but sparse of furniture. We then went to another palace in the same grounds and were entertained to tea by Prince Kan-in and Prince and Princess Chichibu, the Emperor's uncle and brother.

The last outstanding event was the rally of 5,000 boys and girls of the Junior Red Cross, the first of its kind ever held at an International Conference. The proceedings were broadcast, the placard in front of the platform, on which we delegates stood, bearing the inscription, "The Red Cross of to-morrow welcomes the Red Cross of to-day." After the arrival of members of the Royal Family, a boy of 12 (a brilliant scholar) mounted the platform and delivered, with perfect composure, a speech of welcome into the microphone. He was followed by a girl, who did the same. Each child in the rally held a paper flag in either hand, the Red Cross and the Japanese, and, at a signal, waved them. The effect was amazing. Then followed the massed singing of the National Anthem and of the Red Cross song. As we passed through the throng on our departure, I started to shake hands with the nearest children. So many eager arms were thrust out that it was with difficulty the delegates could extricate themselves, but the joy of the children was manifest.

The closing session was occupied with votes of thanks to our kind hosts by each nation, and the end of the Conference came quite suddenly after the days of routine business. The final honour bestowed was the Order of Merit of the Japanese Red Cross on the Head of each Delegation by the Emperor.

The general impression left on us all was that the Conference had been immensely worth while. We had been for a time united in a great international effort to plan for the amelioration of the misery of mankind in war and disaster, and resolved to prevent it as far as possible, and we had all alike shared in the wonderful hospitality, not only of the Japanese Red Cross but of the entire nation. It had been so whole-hearted, and so spontaneous, just their unique way of welcoming their "Honoured" and "Honourable" guests.

My return journey across the Pacific and the United States was chiefly remarkable for visits to Los Angeles, the Grand Canyon and New York. Thence, after an excellent voyage, I arrived home on November 27, my mind stored with instances of international goodwill and friendship, which will remain an indelible memory.

THE PREPARATION OF SUSPENSIONS FOR THE WEIL-FELIX TEST.

By Lieutenant-Colonel R. F. BRIDGES,
Royal Army Medical Corps.

During a period of several months before embarking on his present tour of foreign service the writer devoted himself with some attention to a study of the X strains of *Bacillus proteus*. Much of the work was merely confirmatory of the work of others, but was considered necessary in order to gain familiarity with the handling of these organisms. The ultimate object in view was the preparation of suspensions for the Weil-Felix test of a kind that would be suitable for distribution to the military laboratories of India.

For the benefit of those who are unacquainted with local conditions it may be said that there are twenty-six military laboratories in India and Burma. The number of specimens examined annually in these laboratories is enormous and increasing year by year. It would be practically impossible for the officers in charge to prepare for themselves the whole of the materials which they require in their routine work. For this reason there was established at Kasauli in 1928 a laboratory, known as the Enteric Laboratory, one of the chief functions of which is the preparation and supply of serums and suspensions for agglutination work. In this manner it acts in the same capacity for India as does the Oxford Standards Laboratory at home, an institution with which the Enteric Laboratory maintains a close liaison.

For purposes of investigation six cultures of *proteus* were obtained from the Curator of the National Collection of Type Cultures. The tubes were labelled OX2, HX2, OX19, HX19, OXK, and HXK, denoting the " O " and " H " variants of the three types of *B. proteus* X. As a preliminary, serums were prepared in rabbits from the unselected " H " cultures. At a later stage in the work pure " O " serums were also prepared.

The Flagelllar Antigens of *B. proteus* X.

Attention was first directed to the flagellar antigens, and suspensions for "H" agglutinations were prepared in the usual manner as broth cultures sterilized by 0·25 per cent of formalin. Since the motile "H"-agglutinable organisms do not grow as isolated colonies, but as a film spreading over the surface of the medium, colony-selection in order to obtain suspensions of the highest degree of flocculability is unnecessary and

is even impracticable, except under special conditions of growth. The broth should be inoculated from the spreading growth on a plate, or from the film which rises up the surface of an agar slope when it has been inoculated in the condensation water at the bottom of the tube. If the type of flocculation is not satisfactory, it can be improved by inoculating in the condensation water several agar slopes in succession from the film which rises up the surface of the agar. The sensitiveness of the suspension has not been increased by this method; all that has been done is to improve the flocculability by developing the number of "H"-agglutinable organisms.

Suspensions prepared in the above manner are incapable of reacting to "O" agglutinin to any appreciable extent within the time of two hours normally allotted for an "H" test. Hence they constitute specific indicators for "H" agglutinin only. In the presence of a very powerful "O" serum some traces of granularity may be visible in low dilution, but this is easily distinguishable from the fat flocculation of which the suspension is capable. Craigie (1931) has given a mechanical explanation of this failure of organisms to show "O" agglutination in the presence of formolized "H" antigen.

A complete series of cross-agglutination and cross-absorption tests was carried out on the "H" antigens. The tests showed that these antigens are mainly identical in the three types, but that minor differences do exist. The difference is very small as between HX2 and HX19, but decidedly more marked as between HXK and the other two types. During the whole of the work on the flagellar antigens no evidence was obtained of the presence of type and group phases, such as are found in the diphasic members of the Salmonella group.

The Somatic Antigens of *Proteus* X.

The study of the organisms was then extended to the somatic antigens, a more important matter in view of their connection with the Weil-Felix test. It has been said that three of the cultures obtained from the National Collection of Type Cultures were labelled OX2, OX19, and OXK. Whatever was the condition of these cultures on receipt, it was quickly apparent, when they were examined a fortnight or so later, that in the case of OX19 and OXK the labels had become misnomers. These two cultures had reverted to the "H" form and differed in no way, either in the characteristics of their growth or in their agglutinating properties, from HX19 and HXK.

The matter was otherwise, however, with OX2. Felix (1933) has shown that this particular strain is extremely stable in the "O" form. This finding was confirmed, for at no time in the hands of the writer did this culture show any signs of "O-H" reversion, in spite of the most ardent and prolonged coaxing to induce it to do so.

Since OX19 and OXK had become HX19 and HXK, it became necessary to isolate the "O" variants afresh. This is a simple matter but may take

some days to accomplish. The culture is thinly plated on litmus lactose agar. and after twenty-four hours' growth it will be found that, although the whole surface of the plate may be covered with filmy growth, yet spots are apparent where individual bacilli started to grow into a colony before becoming submerged in the swarm. The point of a platinum needle is lightly touched into the summit of one of these spots and the growth so removed replated. On the following day the amount of filmy growth will be found to be appreciably less than on the first plate, and individual colonies more evident. The same procedure is carried on from day to day, until after five or more such platings isolated colonies are obtained which are entirely purified from filmy growth. A test will now show—one feels it might be safer to write "may show"—that the culture is completely devoid of "H" antigen.

Another method which may be tried is to plate the organism on phenol-agar (1 : 1,500). On this medium discrete colonies are obtained and a number are picked on to agar slopes. After incubation for twenty-four hours it may be observed that on some of the slopes there is less tendency to the formation of filmy growth than on others. By further selection in the same manner a pure "O" strain may at length be obtained.

A point of some importance must be mentioned here. It is often difficult to decide by the appearance of the agglutination whether this is of the "H" or "O" variety. Fortunately the organisms themselves provide a ready means of differentiation; or rather, it would be more correct to say, of determining whether "H" antigen, capable of being agglutinated, is present in the suspension or not. Since the organisms have flagellar antigens in common, but differ in their somatic antigens, all that is required is to test the suspension with the "H" serum of one of the heterologous types. If well marked agglutination occurs rapidly it must of necessity be of the "H" variety, thus proving that "H" antigen is present in the suspension.

During the investigation of the "O" antigens some degree of cross-agglutination was observed between the three types. This was regarded as normal when occurring between OX2 and OX19, since a common somatic factor is known to exist between these organisms. Cross-agglutination was also observed between the highly stable OX2 culture and HXK serum, and might reach as high as 25 or 50 per cent of the serum titre. But in this case the agglutination was of an incomplete type; a few of the organisms only were agglutinated, the majority remaining in stable suspension. On the other hand it was found that if the "O" variant was isolated from HX2 culture and tested with HXK serum this form of cross-agglutination was not obtained. Moreover, it was found that "O" (HX2), as the variant derived from HX2 may be named, was always agglutinated to a higher titre by HX2 serum than was OX2. These facts led one to believe that the complete stability of OX2 in the "O" form must be due to some rough or other degenerative change in the antigen.

The "O" Variant.

The question had now to be considered as to the best form of material to supply to military laboratories in India for use in the Weil-Felix test. Felix (1933) has recommended the use of the living "O" variant in the test, and has described the manner in which it may be maintained in pure condition. The essential feature of this method is the use of dry agar as a culture medium. The possibility of distributing living cultures of the "O" variant was considered, for there is no doubt that, when pure, it is the most sensitive reagent that can be employed. But the tendency of the "O" variant to revert to the "H" form has already been noticed, and it constitutes a serious disadvantage in its use; for the presence of a trace of "H" antigen, even in a living suspension, markedly lowers its sensitiveness to "O" agglutinin. So important is this matter that in one's own work it has become the rule always to test the living suspension for the presence of "H" antigen in the manner previously described, before making use of it in the test.

For the above reasons it was felt that the use of the living "O" variant was unsuited to conditions in India. As we have seen, officers in charge of laboratories are occupied with an enormous amount of bacteriological and biochemical work, and to burden them further with the necessity of keeping a constant watch on the purity of their *proteus* "O" cultures was not practical politics. It seemed, therefore, that the provision of a ready-made killed suspension was clearly indicated, even though this might be somewhat less sensitive than the living culture.

Concentrated Suspensions.

For some time one had been impressed by the advantages afforded in all agglutination work by the use of suspensions in concentrated form; instead of the usual fifteen drops which are added to each tube in a Dreyer's test, one drop only is required, together with fourteen drops, or their equivalent in volume, of physiological saline solution. So far as a central distributing laboratory is concerned, among the advantages arising from the supply of such material may be stressed the greatly diminished cost of packing and postage, no mean advantage in times like the present.

But there are advantages also in practical application. The use of a concentrated suspension enables an agglutination test to be set up in a minimum of time by eliminating much of the drop-counting, so tedious when many serums are being examined. After addition of serum (10, 5, 2, 1, etc., drops in the ordinary way) to all tubes, these are filled up rapidly to about half an inch from the brim, and one drop of suspension is then added on the top. It may be objected that this method must give rise to a considerable error owing to variations in bore of agglutination tubes. With a normal set of tubes this error would be slight in any case; but experiment proves that the error in reading shown in any particular tube is not in proportion to, but is actually much less than, the error in dilution

which may be present. The chief factors which determine whether or not agglutination will occur in any particular tube are the actual quantity of serum present in that tube and the number of agglutinable organisms on which that serum will react. The result is largely independent of the total quantity of fluid in which the two reagents may happen to be floating. "Dilutions" afford a convenient method for setting up the test and reporting its results, but they have not much significance beyond that.

Possible Methods of Preparation.

In the preparation of a killed "O" sensitive suspension from any motile organism several possible methods are available. The "O" variant, isolated by selection from the "H" culture, may be used in the form of a formolized broth culture; or the "O" variant can be grown on agar and washed off into saline containing some reagent, usually formalin, which will kill and preserve the bacilli. Since it was hoped to prepare suspensions in concentrated form, the use of broth cultures was ruled out of court. In both methods it is necessary to ensure that the cultures are completely devoid of "H" antigen, since the effect of formalin on the sensitiveness of the "O" antigen in the presence of "H" antigen has already been referred to. The difficulties which may be encountered in growing the "O" variant in its pure condition have been suggested. These difficulties are in no way lessened when it is proposed to inoculate large surfaces of agar for the mass production of agglutinating material. The need for dry agar has been mentioned; but it is not always possible to ensure that the agar shall be of a suitable degree of dryness on the particular day it is required. The presence of a little moisture may ruin a whole batch.

Growth on phenol-agar (1 : 800) for the suppression of the "H" antigen was tried, for on this medium, as we have seen, the "H" culture grows in the form of discrete colonies with no suggestion of filmy growth. But appearances were deceptive. Tests showed that "H" antigen might still be present in significant amount.

There remained the methods by which the "H" antigen is destroyed, at least so far as its power to agglutinate is concerned. This can be effected either by heat or by treatment with alcohol. In the case of the *proteus* strains the application of heat by boiling rendered the organisms auto-agglutinable, and the more they were boiled the more auto-agglutinable they became. No success attended this method.

Alcohol then was the last resort. It may be applied in one of two ways: by the method of Bien, quoted by Gardner (1931), in which the final concentration of alcohol in the suspension is 33 per cent. This method was not found suitable for the preparation of concentrated suspensions. In the first place, the large amount of alcohol present in the suspension markedly diminishes the size of a drop delivered by a pipette; and in the second place, the drop tends to remain floating on the top of

the serum-saline mixture in the tube. The two fluids must then be mechanically mixed, causing irritating delays.

In the second method alcohol is applied in more drastic fashion. It is added to the saline suspension in excess, and is subsequently removed by decantation and centrifugalization. The organisms are then resuspended in physiological saline solution. From the first this method gave better results than any other, and it was well adapted for the production of suspensions in concentrated form.

One other matter needed consideration—the question of the preservative; for it was found that the resuspended organisms were inclined to become contaminated, unless something was added to prevent this. A number of preservatives was tried, but none was found so satisfactory as formalin. And here a valuable suggestion was received from Dr. Gardner of the Standards Laboratory, Oxford. It is known that formalin-preserved suspensions may be of good quality when first prepared, but tend to deteriorate owing to acidity resulting from disintegration of the formalin. Dr. Gardner suggested that this trouble might be overcome by buffering the formol-saline solution to a pH of 7·6 by means of disodium hydrogen phosphate.

There was no opportunity of putting this suggestion to practical test before the writer received his final embarkation orders. Packing up the *proteus* strains in his "not-wanted-on-the-voyage" kit, he departed for India, where in due course he took over charge of the Enteric Laboratory. It must not be thought, however, that in the immediately preceding years the Enteric Laboratory had been behindhand in the provision of materials for the Weil-Felix test. Alcoholized suspensions of several *proteus* strains had been prepared in dilute form for some years and regularly supplied to laboratories inquiring for them.

Selection of Cultures and Colonies.

In the Enteric Laboratory at this time a number of strains of *proteus* X were available to choose from, and it was found that they differed somewhat in the liveliness of their response to "O" agglutinin. Of type X19 there were the Muktesar and Warsaw strains referred to in a previous paper (1934), both of them in the "H" form. There were also the OX19 (?) and HX19 which had been brought out from home. Tests showed that of these strains the Muktesar culture was the most sensitive to "O" agglutinin, and it has therefore been used throughout for the preparation of suspensions. Of type XK there was a strain which had been obtained from Malaya some years previously, together with the OXK and HXK which had been brought out from home. Of these the Malay strain gave the best results. In the case of type X2 there were only available the OX2 and HX2 brought from home. For reasons already given OX2 was regarded as an unsuitable culture to use.

Although the difference is not very great, it has been commonly found

that in the alcoholizing process the "H" culture has given better results and has produced a more highly sensitive suspension than the pure or semi-pure "O" variant. The reason for this is not clear, but it may be due to the fact that the "O" variant has already been subjected to a process of selection, not however with a view to obtaining the most sensitive colonies, but solely with the object of isolating those organisms in which the power to develop "H" antigen has been suppressed. It is possible that during this process the less sensitive colonies may have been picked. However that may be, the fact that "H" cultures give better results absolves one from the necessity of trying to maintain "O" variants in pure conditions, or indeed of keeping them at all.

If it is desired to produce suspensions of the highest possible degree of sensitiveness, showing rapid and clean agglutination with a sharp end-point, it is advisable to prepare them from a single selected colony. On the other hand, if time is short or if one is satisfied with suspensions of a somewhat inferior quality, then this procedure of colony-selection may be omitted, and the suspensions prepared in blunderbuss fashion from the whole culture.

Notes on Technique.

The technique which was ultimately adopted for the preparation of concentrated alcoholized suspensions is given in Appendix I.

Some notes will now be made on the method.

Alcohol.—It will be seen that, both in the preliminary test for selection of colonies and in the final process, the amount of alcohol used is rather large, and indeed seemed likely to become somewhat a strain on the financial resources of the laboratory. For this reason methylated spirit was tried in its place and found to be quite as effective as the purest alcohol available. Methylated spirit is, of course, much cheaper than alcohol, and, in fact, costs the laboratory nothing, being a "free issue" to laboratories in India by the Indian Army Service Corps. The spirit should be filtered quite clear of deposit or opalescence before use.

Resuspension of the Organisms.—It is inadvisable to resuspend the organisms direct in a formol-saline solution, for if this be done great difficulty may be experienced in smoothing out the clumps and obtaining a suspension entirely free from granularity. A measured quantity of sterile saline should be added first. Then, after the material has been transferred to bottles and vigorously shaken, 2 per cent buffered formol-saline solution is added in the proportion of one part to seven parts of suspension. This gives a final concentration of formalin of 0·25 per cent.

Standardization.—When one drop of suspension of a concentration equivalent to 6,700 million *B. coli* per cubic centimetre is added to an agglutination tube filled with saline, the resulting opacity in the tube is rather greater than that commonly employed in an agglutination test. But it is thought that with this rather greater density of organisms the inter-

mediate readings between "total" and "trace" are more readily perceived.

Standardization should be carried out with care, since it affects the sensitiveness of the suspension. Some not very exact tests showed that if the density of the suspension is reduced to a half, its sensitiveness is increased by about 40 per cent; and if density is reduced to a third, then sensitiveness is increased by about 80 per cent. These figures are only approximate, but they are sufficiently accurate to show that, in contrasting the sensitiveness of any two suspensions the question of their comparative densities is a matter of considerable importance; and it is one that is commonly overlooked.

In practice the following method of standardization is adopted. Tube 3 in Brown's series only is used, since it is thought to be more easily matched than any other. On the scale in use this tube has a value of 1,230 million *B. coli* per cubic centimetre. Hence the density required in the suspension is 5·5 times the value of tube 3. One volume of suspension is diluted with volumes of saline until it is found to match tube 3. Then the amount of fluid which must be added to bring the suspension to the required density is calculated from the following formula :—

$$\frac{(a - 5{\cdot}5)\,x}{5{\cdot}5}$$

where "a" is the number of times the suspension must be diluted to bring it to the value of tube 3, and x is the volume of suspension to be diluted. Thus, supposing we have 50 cubic centimetres of suspension and it is found that it must be diluted with eleven volumes of saline, or twelve times, to bring it to the density of tube 3, then the quantity of fluid which must be added to give a concentration equivalent to 6,700 million *B. coli* per cubic centimetre is equal to $6{\cdot}5 \times 50 \div 5{\cdot}5$, or 59·1 cubic centimetres. This fluid is added as to seven-eighths in the form of sterile saline and one-eighth of 2 per cent buffered formol-saline. The concentration of formalin is thus retained at 0·25 per cent.

Incubation.—Felix and Olitski (1929) have shown that the temperature of incubation should not be too high, since the agglutinin in a typhus serum is markedly heat-labile. When using alcoholized suspensions a temperature of 50° to 52° C. in the water bath for four hours followed by all night in the 37° C. incubator gives good results. On the following morning the racks should be returned to the water bath for a few minutes before reading the test. This freshens up the tubes and renders the end-point more decisive.

Incubation throughout at 37° C. is also satisfactory, but the higher temperature has the advantage that within an hour one can see whether the test will be positive or negative, and obtain a good idea of what the end-point will be.

Reading the test.—A scheme for determining the point of standard agglutination is given in Appendix II. This is based on Dreyer's reduction

table (1920) with the figures reduced to round numbers. It is felt that those who do not make use of interpolation figures of this kind, but are content to read their tests merely to the dilution-value of the tube in which the end-point occurs, are rejecting much information of value that the test can afford.

Summary.

Concentrated alcoholized suspensions prepared in the manner described are believed to have given good results throughout India, and to have been the means whereby many cases have been diagnosed typhus fever, which otherwise might have been classed as enteric group, etc. These suspensions retain their agglutinating properties unimpaired during storage for at least six months, and they do not become contaminated except under conditions of gross ill-usage.

It is true that living suspensions of the "O" variant are more sensitive, to the extent of perhaps 50 per cent, but one would not regard them as superior reagents for that reason alone. They may be recommended to those who have the time and experience necessary to use them with discretion, but they are considered unsuitable for routine use in busy laboratories ; neither are they suitable for those laboratories in which it is only required to carry out a test occasionally. In such cases certainty and uniformity are thought to be more desirable qualities than a very high degree of sensitiveness.

APPENDIX I.

Technique of Preparation.

(1) Plate the culture to be used on phenol-agar (1 : 1,500) to ensure growth in single colonies. Incubate twenty-four hours.

(2) Pick a number of colonies, say six, each on to two agar slopes, and incubate for twenty-four hours. The one slope is used for test, the other is kept as "office copy."

(3) Add about two cubic centimetres of saline to each test slope and wash off the growth.

(4) Pour off the suspensions into clean tubes and fill the tubes about three-quarters full with alcohol. Shake up all the tubes and put them aside for twenty-four hours.

(5) Pipette off as much as possible of the clear supernatant alcohol, leaving the deposited organisms. Fill the tubes half full with saline and shake up thoroughly. Dilute further with saline and reduce to suitable density for agglutination test.

(6) Test all suspensions with type serum in a series of dilutions depending on the titre of the serum. Choose that suspension which agglutinates most rapidly, most completely, and to the highest titre.

(7) Growth in bulk is carried out in Roux bottles or screw-capped "medical flats" (McCartney 1933) which have been coated on one side with unfiltered agar. Pour into each bottle the contents of one broth tube which has been inoculated rather heavily from the office copy of the selected colony. Allow the broth to

flow over the whole surface of the agar. Incubate for twenty-four hours with the bottle on a slope so that the broth remains at one end.

(8) Add a small quantity of saline to each bottle and wash off the growth. Filter through cotton wool into narrow-mouthed bottles. Add alcohol in the proportion of not less than four volumes to one volume of suspension. Tightly cork the bottles and shake up thoroughly several times. Stand the bottles aside for twenty-four hours.

(9) Pour off as much as possible of the supernatant alcohol and transfer the remainder containing the organisms to centrifuge tubes. Swing rapidly for a few minutes. Pour and pipette off the whole of the alcohol.

(10) Grind up the organisms in sterile saline and transfer to sterile narrow-mouthed bottles. Tightly cork the bottles and shake very thoroughly until it is seen that all clumps have been smoothed out and no trace of granularity remains.

(11) Add 2 per cent buffered formol-saline to make the concentration of formalin 0·25 per cent.

(12) Standardize the suspension by adding more sterile saline and 2 per cent buffered formol-saline (final concentration of formalin 0·25 per cent) to a density equivalent to 6,700 million *B. coli* per cubic centimetre.

APPENDIX II.

Scheme for Determining the Point of Standard Agglutination.

(Based on Dreyer's reduction table.)

	25	50	125	250	500	1,000	2,500	5,000
trace minus ..	15	30	75	150	300	600	1,500	3,000
TRACE	17	35	85	175	350	700	1,750	3,500
trace plus ..	20	40	100	200	400	800	2,000	4,000
standard minus ..	22	45	110	225	450	900	2,250	4,500
STANDARD ..	25	50	125	250	500	1,000	2,500	5,000
standard plus ..	27	55	135	275	550	1,100	2,750	5,500
total minus ..	30	60	150	300	600	1,200	3,000	6,000
TOTAL	35	70	175	350	700	1,400	3,500	7,000

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NOTES ON SEVEN CASES OF THE INDIAN TYPHUS-LIKE FEVERS.

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Work is at present being carried out on the typhus group of fevers in India. In view of this, the notes on seven cases collected during my tour of Indian Service will be of interest. They give an account of the clinical history, and in one fatal case the post-mortem findings.

Sir John Megaw [1] opened a discussion on "Typhus Fevers in the Tropics" in the Section of Tropical Diseases at the Annual Meeting of the British Medical Association, Bournemouth, 1934. In this he dealt with the different varieties of typhus and suggested a classification of the fevers according to the vector.

These fevers in India have been known particularly as a result of the work of Sir John Megaw [2] on the variety of typhus occurring in the Kumaon Hills. Cases from other parts of India have been reported in recent years in the Journal of the Royal Army Medical Corps, from Bangalore by Biggam [3], 1932, from Delhi by Christian and Hepple [4], 1932, and from Karachi and Quetta by Lindeman [5].

A summary of some of the important contributions to the subject of these fevers is given in the introduction to Biggam's paper [3], 1932. The Weil-Felix reaction in these fevers has been discussed by Bridges [6], 1934. The serological types of typhus virus and corresponding types of *B. proteus* have been discussed by Felix [7], 1933.

The seven cases of typhus-like fevers, of which the description is given below, occurred in Jubbulpore, Bareilly and Peshawar. Two of the patients gave a history of being bitten by ticks. One of these cases terminated fatally. The other cases deny being bitten by ticks, fleas, lice, or any other insects, except in some cases by mosquitoes.

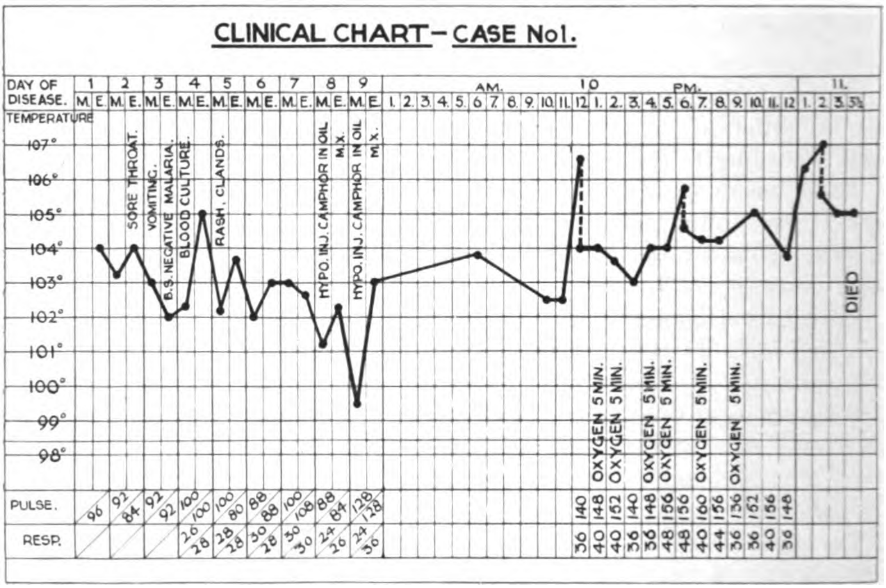
Table of Cases.

Case No.		Locality	Date admitted to hospital	Days pyrexia	Remarks
1	British	Jubbulpore	27.8.1929	11 (died)	Bitten by ticks
2	British	Jubbulpore	28.8.1929	11	—
3	British	Jubbulpore	28.1.1930	19	—
4	British	Jubbulpore	20.3.1930	15	—
5	British	Jubbulpore	9.11.1930	14	—
6	Eurasion	Bareilly	28.9.1931	22	Bitten by ticks
7	Indian	Peshawar	17.1.1932	20	—

Case 1.—Pte. J. (B.O.R.), age 23, 2nd P.W.V.

Clinical History.—Private J. had been out shooting in the jungle on several occasions before he became ill. The last time was a few days before admission into hospital. Although there is no evidence to show that he was bitten then, his friends stated that on previous occasions he used to show them the ticks hanging to his legs and thighs after returning from shooting. It was impossible to fix any definite dates when he was bitten.

First day: He was admitted to hospital on August 27, 1929. Fever commenced during the night. Dull and lethargic and very slow in answering questions. Complained of a severe headache. General malaise, photophobia, injected conjunctivæ, rhinitis and bronchial catarrh were the



prominent symptoms. Vomited several times during the day. Appeared to be very ill and suffering from some severe intoxication.

Third day: Delirious. Bronchitis worse.

Fourth day: Although his general condition had improved there was no change in the bronchitis. A rash had appeared. This was a blotchy erythema in irregular patches, dull red in colour, covering the chest, abdomen and extremities, but not present on the face or neck, nor on the mucous membrane of the mouth. Margin of the rash not raised. Inguinal lymph glands enlarged. (The case at this stage resembled a severe measles, and as such cases were occurring in the station, a provisional diagnosis of measles was made.)

Fifth day: The improvement of the previous day was not maintained. A severe bronchitis with copious sputum developed. Rash tended to

coalesce and became darker in colour. The cervical and axillary lymph glands had become enlarged since the previous day.

Sixth to eighth day: This period was characterized by the development of the bronchitis into a pneumonia. The condition of the patient gradually deteriorated and a typical typhoid state developed. The rash assumed a mottled appearance. Petechiæ appeared on the chest and sides of the abdomen, and later became very numerous. At noon on the eighth day the patient collapsed and became cyanosed and pulseless, but rallied.

Ninth to eleventh days: Delirium and coma were marked. There were periodical maniacal outbursts, when great difficulty was experienced in restraining the patient. Dyspnœa and cyanosis were prominent symptoms, and signs of cardiac failure became evident on the morning of the tenth day. At noon on that day he became unconscious. Hyperpyrexia and incontinence of urine were present, and he died at 3.30 a.m. on the eleventh day without regaining consciousness.

Treatment.—During the early stages the patient was given diaphoretics, gargles and inhalations. When the bronchial condition became worse an expectorant mixture was given. Omnopon was given for sleeplessness, and hyoscine during the delirious and maniacal periods. During the later stages on the eighth day all oral administrations were discontinued. Cardiac stimulants and oxygen were then given. On the last day rectal salines were tried but could not be retained.

Post-mortem Report.—The body was that of a well-nourished and well-developed man. Post-mortem staining was well marked in the dependent parts. The mottled rash was seen very distinctly. Petechiæ were present all over the body except on the face.

Thorax: The pericardium was thickened and had a leopard skin-like appearance due to hæmorrhages into the substance. Many very minute hæmorrhages were also present between the larger ones. The pleura had a similar appearance but the hæmorrhages were not so well marked. No fluid was present in the pleural or pericardial cavities. Heart blood was taken for culture. The blood was fluid, blackish in colour and viscid. No post-mortem clotting was present. The heart weighed 14½ ounces and contained ante-mortem clots. No post-mortem clotting was present. Small nodules about the size of a pea were removed from between the trabeculæ. The heart muscle was pale, the left ventricle normal, and the valves showed no vegetations, the right muscle was dilated and flabby, and was lined by a muco-serous slimy membrane which could be stripped off. Hæmorrhages were present in the ventricular substance. The aorta appeared normal; no clotting was present. The right lung weighed 31½ ounces, the base was slightly adherent posteriorly, and there was marked congestion of the whole lung with basal pneumonia. On section a frothy blood-stained exudate appeared. The left lung was less congested than the right and weighed 30 ounces; there was an enlarged gland present at the base. Otherwise the condition was similar to that of the right lung.

Abdomen : Large hæmorrhages into the peritoneum and intestines were visible. The liver weighed 80½ ounces, petechial hæmorrhages were visible on the outer surface and the inferior aspect was stained blue; this extended into the liver to a depth of ¼ inch which on section presented a nutmeg appearance. The vessels were patent and when pressed blood exuded freely. The gall-bladder was adherent and only freed with difficulty from the liver. It was full of bile and was greatly thickened, showing signs of previous inflammation. No gall-stones were found. The spleen was enlarged and weighed 13 ounces. The capsule was thickened and full of hæmorrhages but stripped off easily. The substance was very fragile and congested, and appeared darker than normal owing to the colour of the blood. The omentum was matted and slightly congested. The intestines were distended with gas, which did not have a very foul odour. The Peyer's patches of the small intestine appeared normal, but there were some signs of slight congestion present.

The stomach was collapsed and empty and normal in appearance. The left kidney weighed 8 ounces and was much larger than the right. Hæmorrhages appeared in the capsule which stripped off easily. On section the substance showed the medulla and cortex clearly differentiated, but paler than normal. The enlargement of this kidney was uniform and did not appear to be pathological. The right kidney weighed 4 ounces and its general appearance was similar to that of the left kidney. The pancreas weighed 4½ ounces and was normal in appearance.

The brain was not examined.

Portions of the following organs were fixed in formol saline : Kidney, liver, spleen, lung, pancreas, heart, also inguinal lymph glands and a nodule from heart. No organism was isolated from heart-blood taken at the post-mortem, but *B. fæcalis alkaligenes* was isolated from cultures of the intestinal contents made at the same time.

Morbid Histology.—Kidneys: Cloudy swelling was present. Some of the tubules were so distended that the space was completely occluded. The cells seemed to be filled with a clear fluid and this was found in small areas throughout sections examined. It was difficult to decide whether this fluid was a serous or dropsical degeneration or really due to an autolytic process. The cell nuclei of both tubules and malpighian corpuscles only stained faintly. In some places signs of necrosis were present. A round cell infiltration was also present and was most marked in the malpighian corpuscles. Numerous hæmorrhages, most evident in the region of the loops of Henle, were also seen.

Liver : Marked congestion and hæmorrhages with an increase of fibrous tissue were noticeable features under the low power examination. Focal necrosis was present and cloudy swelling was seen everywhere. There was a round-cell infiltration which was most marked in the portal canals. Here the congested veins were a prominent feature. An arteriolitis and a periarteriolitis were seen. The Kuppfer cells seemed to be normal.

Spleen: Hæmorrhages were prominent. Small nodules, 13·32 millimetres in diameter and surrounded by a ring of leucocytes, were seen in all sections. The arterioles showed an arteriolitis and a peri-arteriolitis, while the endothelium appeared to be degenerated.

Heart: The muscle showed cloudy swelling. The cell nuclei stained faintly or not at all, and a round-cell infiltration was present throughout the substance. The endocardium was heavily invaded. The presence of an arteriolitis, with a degeneration of the endothelium, was a striking feature in all sections. Nodule from heart: This consisted of a mass of connective tissue with a round-cell infiltration.

Lungs: These showed changes consistent with lobar pneumonia at the bases and a severe bronchitis in other parts.

Pancreas: Although the glandular structure appeared normal, there were some hæmorrhages and small localized areas of round-cell infiltration.

Lymph gland (inguinal): Enlargement due to inflammatory changes.

Commentary on Post-Mortem Report and Morbid Histology.

(1) The changes described are those common to many acute infections, and are not in themselves characteristic.

(2) The inflammation of the arterioles and the degeneration of the endothelium are the vascular changes described as occurring in true typhus.

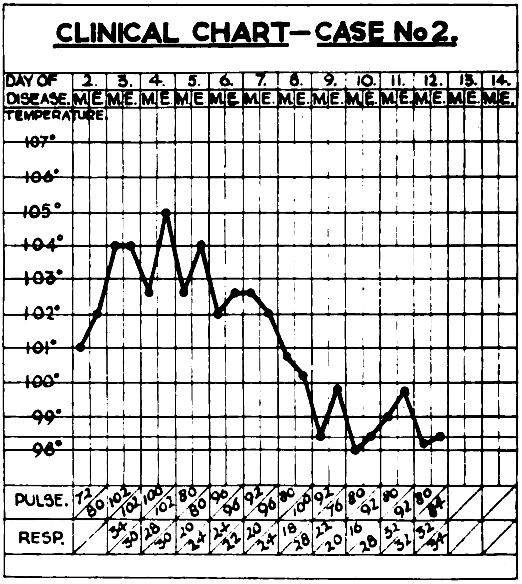
(3) Although looked for among the endothelial cells in the liver, in the spleen and in the blood, no bodies that definitely resembled the Rickettsia bodies were seen.

Case 2.—Pte. C. (B.O.R.). aged 27, 2nd P.W.V.'s.

This patient was admitted into hospital a day after Case 1. Although in the same battalion the men belonged to different companies and were not contacts. The two cases ran an almost identical course. After being seriously ill for seven days there was a marked improvement on the eighth day, with amelioration of the lung condition. It was on the eighth day of the disease that Case 1 collapsed and afterwards became progressively worse.

It is interesting to note that there was a difference between the rashes in the two cases. In Case 2, a maculo-papular rash was present in addition to the diffuse blotchy erythema. This maculo-papular element was of a more dusky colour than the rest of the rash. It was present everywhere, including the soles of the feet and palms of hands, but not on the face. The brown staining from this persisted long after the patient was up and after the rest of the rash had disappeared.

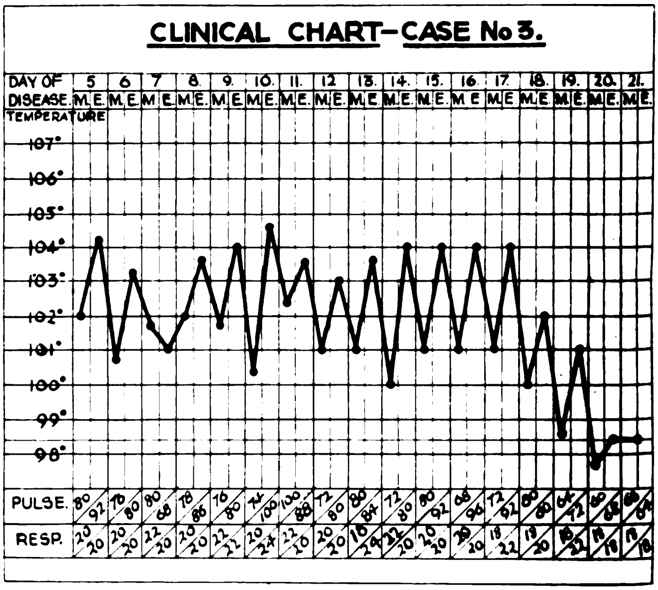
The submaxillary, anterior and posterior cervical glands were enlarged, but not the inguinal nor the occipital.



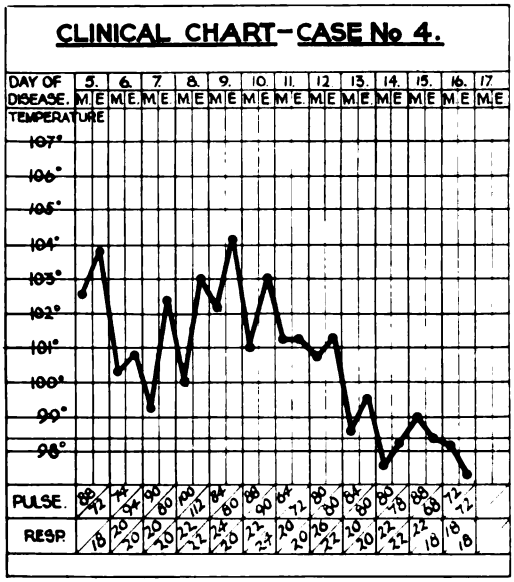
Cases 1 and 2 differed from the other cases in having a shorter but much more severe illness. The fever lasted for eleven days in Case 2, while in the other cases there was a fourteen to twenty-two days fever. In none of the other cases was there such a severe intoxication as in Cases 1 and 2.

As the course of the disease in the other cases was similar they can be described together.

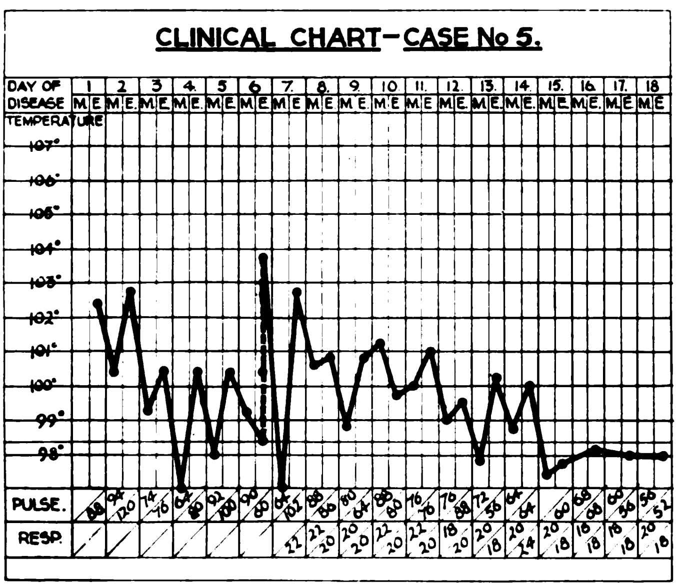
Case 3.—Pte. S. (B.O.R.), aged 20, 2nd P.W.V.



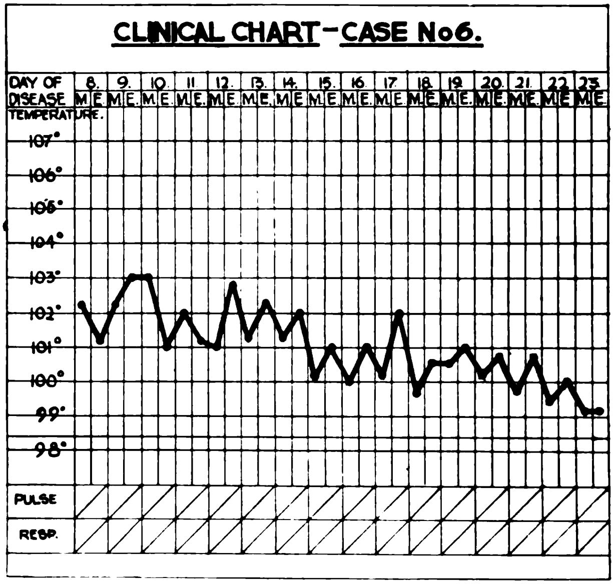
Case 4.—Fusilier S. (B.O.R.), aged 30, Royal Fusiliers.



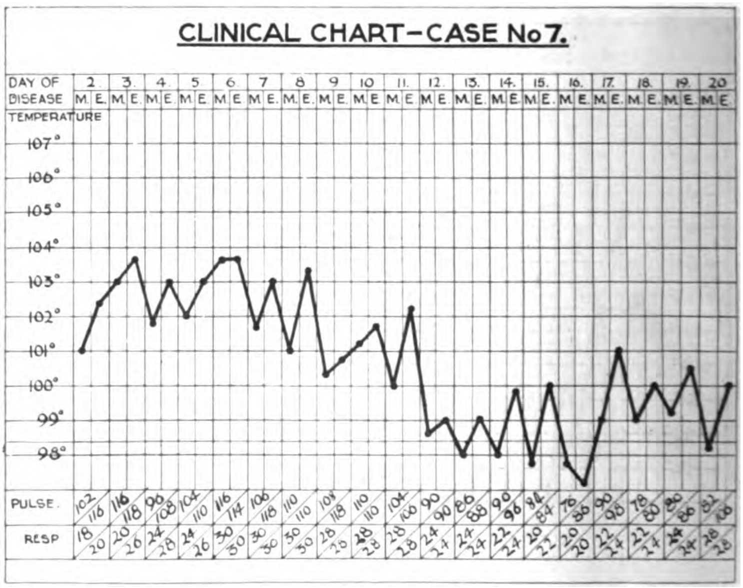
Case 5.—Pte. M. (B.O.R.), aged 21, 2nd P.W.V.



Case 6.—Mr. L. (Eurasian), aged 35 (aprox.), Railway.



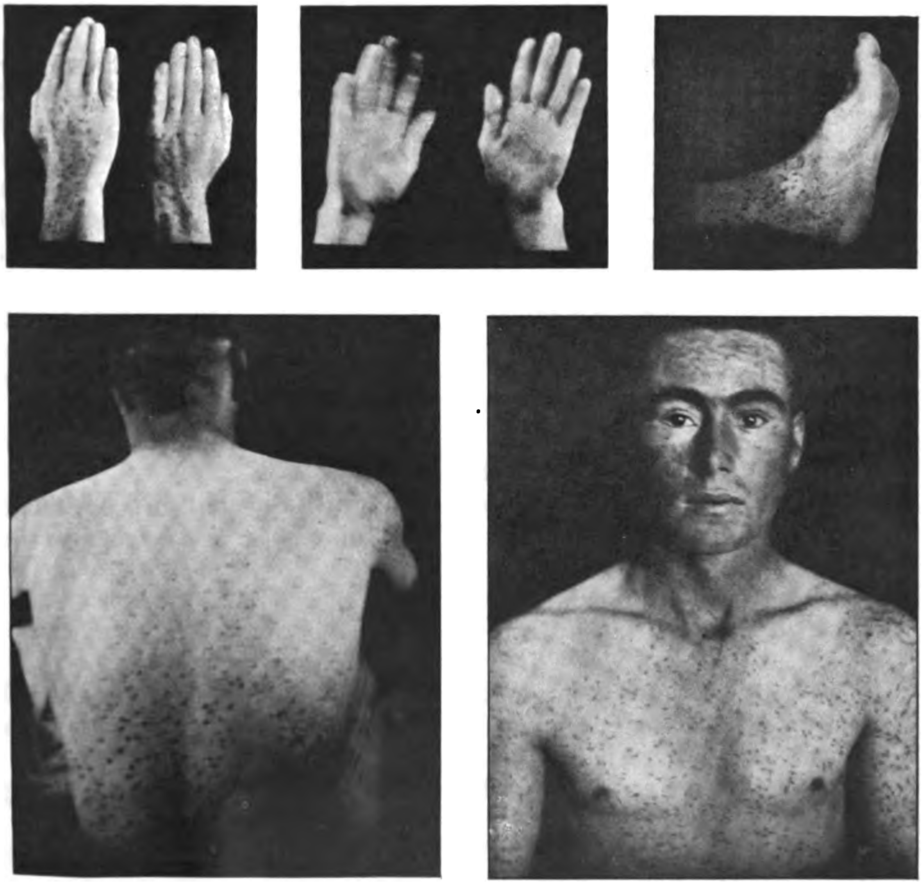
Case 7.—Fitter J. S. (I.O.R.), aged 30, 15 Batt. Royal Artillery.



In these cases there were no characteristic symptoms to distinguish the disease from other febrile conditions until the appearance of the definite maculo-papular rash on the fourth and fifth days of disease. During the pre-rash stage, the symptoms were chiefly those of catarrh and general malaise. The onset was sudden with severe headache. Case 4 complained of severe joint pains and pains in the back. These symptoms persisted throughout the illness. Case 3 had a very severe tonsillitis with a muco-purulent exudate. He was given antidiphtheritic serum as a precautionary measure, pending receipt of the culture report from the laboratory. All the other cases suffered from some degree of pharyngitis.

One of the most characteristic features of the cases was the gradual change from the catarrh into the broncho-pneumonia which was fully developed between the sixth and eighth days after onset.

Rash of Case 3.



The rash appeared on the fourth and fifth day of the illness, and it generally commenced as a subcuticular mottling on the chest, back and thighs. This was of a dull brick-red colour. The face was usually flushed.

The maculo-papular element appeared either on the same day as the mottling or on the next. It appeared first on the chest and back and then extended down the thighs and arms until the whole of the lower limbs, including the soles of the feet and the whole of the upper limbs including the backs and palms of the hands, were covered with the maculo-papular eruption. With the exception of Case 5, the rash invaded the face, and in Cases 3 and 7 there were a few spots on the palate, but not on the mucous membrane at the sides of the mouth. In all the cases there were large numbers of petechial hæmorrhages all over the body. The axillæ alone seemed to be relatively free from rash.

The rash took from eight to twelve days to become fully developed. The photographs of Case 3 were taken on the twelfth day, and show the distribution of the rash very well. The macules became a dull red colour and persisted for at least a fortnight after the temperature reached normal. There was no amelioration of symptoms after the appearance of the rash, in fact the condition of the patients became worse.

Other symptoms in the post-eruptive stage were drowsiness, bronchopneumonia and general anxiety, although none of these cases developed the delirium or mania of the first two. Constipation was a very marked feature and could only be relieved by enemata. Insomnia was not complained of, nor was the "mousy" odour present. The bronchopneumonia was the most distressing feature of the cases and called for very careful nursing. Case 4 had several rigors, blood smears were negative to malaria. Splenic enlargement occurred only in Cases 4 and 7. In both the enlargement was painful. Case 3 complained of tenderness of the skin covering the tips of the ears and fingers. A noticeable feature in all cases was the relation of pulse to temperature, the pulse being relatively slow. Knee-jerks were either greatly diminished or absent.

These constitute the main symptoms as noted in the different cases. The laboratory findings are given below.

Case 6 was a civilian patient whom I saw with the civil surgeon. The patient gave a history of finding a tick on his chest five days before the onset of the illness.

Treatment was symptomatic.

Laboratory Findings.

Blood cultures were taken on the fourth and sixth day of disease and on other dates depending on the condition of the patient. Bile salt broth and glucose broth were used. All results were negative.

Urine and fæces were cultured both during the disease and during convalescence with similar negative results.

Blood counts. There was nothing of diagnostic value in the blood counts. The total and differential white cell counts were within normal limits. Only in Case 4 was there any marked change of importance, and in this the differential white cell count on the ninth day showed a large increase in the large mononuclears at the expense of the polymorphs.

Blood smears were taken during the first three days of the disease to exclude malaria.

Agglutination tests. No agglutination tests were carried out in Case 6. In the others three or four agglutination tests were carried out in each case. The usual Widal was done using "H" emulsions of *Bacillus typhosus, B. paratyphosus* A, *B. paratyphosus* B and *B. paratyphosus* C, and an "O" emulsion of *B. typhosus*. Unfortunately "H" agglutinins only were tested for with the *B. proteus* X group, except in Case 5, where strains Warsaw and Muktesar of *B. proteus* X19 and *B. proteus* X Kingsbury were used.

In all cases a sympathetic rise in the heterologous "H" agglutinins of the enteric group organisms occurred, but no agglutination occurred with *typhosus* "O" emulsion. While not attaching much importance to the "H" agglutinins of the *proteus* X group, it is interesting to note that Cases 1 and 2 failed to agglutinate such organisms in higher dilutions than 1 : 50. In Cases 3 and 4 there was a rising titre of 1 : 250 to 1 : 1000 against the X 19 "H" strains. The details of the findings in Case 5 are given below :—

Day of disease :	7th		10th		17th
B. proteus X19 "O" ..	Nil	..	1/250	..	1/500
B. proteus Kingsbury "O"	Nil	..	Nil	..	Nil

Commentary.

The disease is characterized by its protean manifestations. The cases described bear a close resemblance to the common louse-borne typhus, but the presence of the rash on the face, the absence of a leucocytosis, the absence of the "mousy" odour and the relatively slow pulse are points in which they differ.

The sudden onset, early prostration, the negative blood cultures, and the appearance and type of the rash generally serve to distinguish these infections from fevers of the enteric group, but a para-typhoid fever with a diffuse rash may make diagnosis difficult. Agglutination tests should assist.

In the early stages the disease may resemble measles, but the absence of Koplik's spots, the darker rash and the subsequent course of the illness will serve to distinguish between the two.

The diseases mentioned above are those most likely to be encountered and from which a diagnosis may have to be made. So long as the possibility of the disease is thought of, diagnosis is not difficult.

It has been impossible to determine the vector. In two of the cases the tick seems to be incriminated.

With regard to the agglutination results, most of the cases appeared to be related to the *B. proteus* X19 rather than to the *B. proteus* X Kingsbury.

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[2] Megaw, J., Shettle, F. B., and Roy, D. N. *Ind. Med. Gaz.*, 1925, lx, 53.
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[4] Christian, C. R. *Ibid.*, 1932, lix, 445.
[5] Lindeman, S. J. L. *Ibid.*, 1933, lx, 136.
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AN EPIDEMIC OF TYPHUS (VECTOR UNKNOWN) IN THE SIMLA HILLS.

By Major C. V. MACNAMARA,
Royal Army Medical Corps.

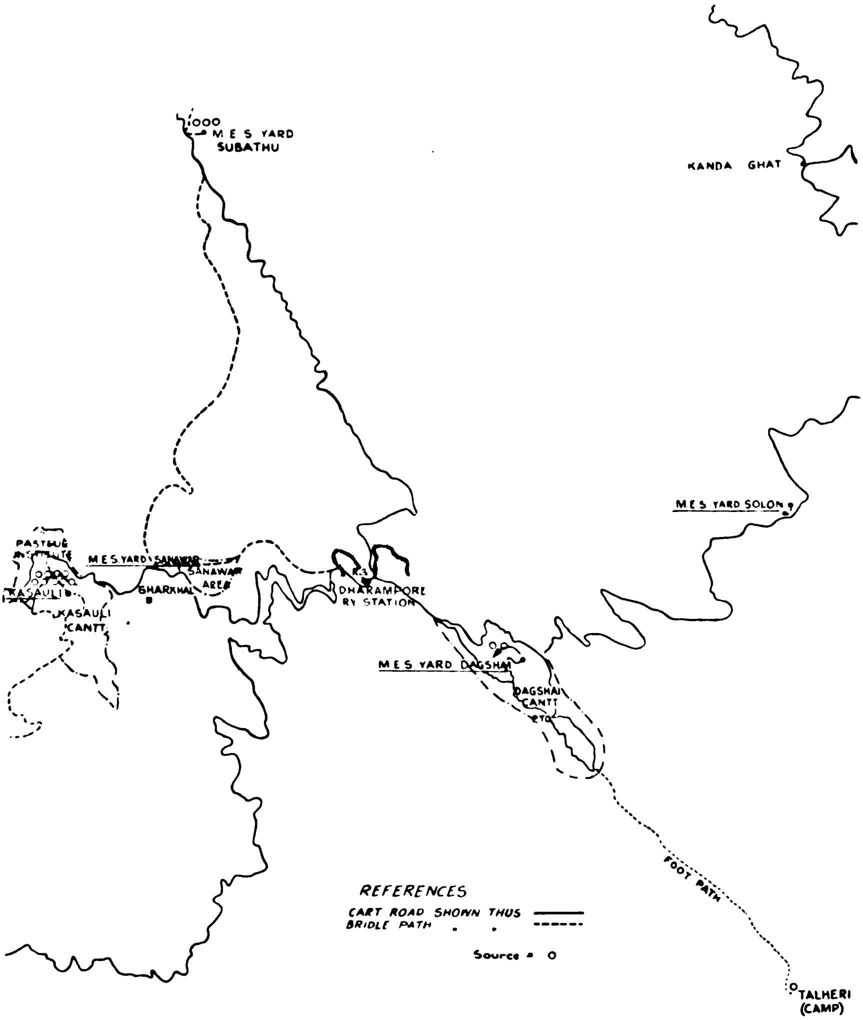
For the third successive year, a series of cases of typhus fever has occurred in the Simla Hill stations of Sabathu, Dagshai and Kasauli. The disease appears to be new to the district, and there is no record of it prior to 1932. In that year five cases with two deaths occurred at Sabathu. In 1933 ten positive and four clinically positive cases were reported from the three cantonments. It appears probable that the present series will comprise fifteen positive cases and one doubtful case.

The present series of cases commenced during the last week of August, 1934, beginning almost simultaneously in the three stations. It is of interest to note that one of the cases was apparently infected at Talheri Camp, a fishing centre eight miles from Dagshai. This camp has a bad reputation for ticks and fleas. The earliest date of onset traceable is August 27, at Kasauli; 6 cases had occurred by the end of the month, 4 at Kasauli, 1 at Talheri (Dagshai) and 1 at Sabathu. During the first week of September, 6 further cases occurred, 3 at Kasauli, 2 at Sabathu, and 1 at Dagshai. A further case was reported from Kasauli on September 10 and another occurred on September 27 at the same station. On October 1 two cases originated, one at Dagshai and a doubtful case at Kasauli. Presuming an incubation period of ten days, now apparently confirmed for animals by the Director of the Central Research Institute at Kasauli, the period of infectivity of the unknown carrier lies between the middle of August and the fourth week in September, coinciding closely with that observed in the previous epidemic. At this season the monsoon is terminating, and the disease may be said to cease with the rains.

Hitherto nothing has been discovered as to the cause of the infection in this area. It is supposed that the disease is transferred from an animal by an arthropod vector and the distribution and dates of onset of the cases (Appendix I) appear to support this theory. It is evident that the disease must be due to some widely distributed common factor. Natural transference from one human being to another appears not to occur, and many cases have been treated in common in wards without mishap. Search of the person and clothing of the infected cases invariably fails to reveal infestation, and the environment of the soldier in these cantonments is such as to render the possibility of infestation remote. Indeed, the difficulty is that as a rule no history or trace of a "bite" can be discovered, though exceptional cases have shown inflamed macules which might be attributed to the action of parasites.

The Indian population appears to be little affected. No cases have been

treated at the Cantonment Hospital at Kasauli, and no reports of severe fever have come in from the bazaars and villages. It is probable that a few cases do occur; the Central Research Institute reports one case among its employees, and another was reported from Sanawar last year. The majority, however, have occurred among young male Europeans living in



barracks or bungalows. Three cases, possibly four, have occurred among children. It is of interest that no woman has yet contracted the disease.

It has been pointed out by Lieutenant-Colonel Covell, I.M.S., one of the sufferers, that the common Indian squirrel has recently been imported to this district. This animal was brought to Kasauli for research purposes in 1924, and has gradually acclimatized itself. Since 1930 it has become very common indeed. It nests in the roofs of barracks and bungalows and

Colonel Covell considers it a possible vector. Investigations are now being carried out at the Central Research Institute at Kasauli, and the infection has apparently been transferred to squirrels, rats and mice from human cases. The experiments are as yet incomplete. It is stated that the blood serum of squirrels is capable of agglutinating emulsions of *Bacillus proteus* OXK in some degree. This also appears to be the case among healthy residents, as the blood of uninfected patients has given positive Weil-Felix tests in low dilutions.

It is of interest to note that severe cases may occur either early or late in the series. The most severe case in the present epidemic had the latest onset. The disease appears to be severer than in 1932.

The clinical picture is very characteristic. The onset is sudden, there being no prodromal period. It is characterized by headache, severe and persistent, usually described as "darting" or "throbbing." This is usually occipital and is associated with pain in the back of the neck. Pain behind the eyes and on moving the eyeballs is a common but not constant feature, later the headache may become general. A painful sensation in the scalp on touching the hair has been noted. Anorexia and malaise appear very early and lassitude is very pronounced. Vomiting is uncommon. The patient takes to his bed as a rule on the day of onset, as this is an easy matter in barracks in the hills, but does not report sick. He sleeps well and is usually better the following morning, but headache soon returns, a shivering attack usually occurs during the second day. He again takes to his bed, borrows extra blankets, perspires freely and sleeps later. Men who have had malaria diagnose a relapse. Daily rigors are a feature of the disease before the appearance of the rash. The skin acts freely. Some cases avoid admission to hospital for several days, but the majority are made to report on the second or third day of disease.

The appearance on first inspection is quite striking. The patient lies like a man in severe pain, prone or curled up on his side. He is unwilling to move his head. A ward full of these cases is remarkable for its silence and stillness. The patient takes little interest in his surroundings. When spoken to, however, he is alert and sensible. He states at once that all that is wrong with him is headache. He is quite ready to speak when spoken to, and does not object to moving when his interest is aroused. The face is somewhat flushed, and the conjuctivæ a little injected. The sclerotics have lost their clear tinge. The tongue has a thick yellow central fur, the edges and tip being clean. The throat is normal. There is usually no cough on admission. The pulse is normal, there being no trace of fullness, softness, or dicroticism. High fever is usually present, and the pulse is slow in relation to the temperature.

On examination it is found that the systems are unaffected. The lungs are clear, the heart sounds normal. There is no enlargement of liver or spleen. The abdomen is flaccid, and the bowels as a rule have acted normally. The urine is free from albumin and sugar. The reflexes are present and normal. The skin may show a slight flush if the patient is in

the fourth day of the disease; it may be dry or moist, but it is not hot and burning to the touch. Mentally the patient is lucid, but lassitude is very evident. It appears to be entirely due to the headache. This is described as "throbbing," "stabbing," "like a knife" or "just an ache." There is sometimes pain on moving the eyes, and the patient is disinclined to turn his head. Occipital headache and pain in the back of the neck are common, but there is no head retraction.

The rash appears on the fifth day of the disease. A flush may be present on the fourth day. This may be demonstrated on an apparently normal skin by the pressure of the hand. The paler impression produced by the palm and fingers persists on the skin. The rash is that of true typhus, though the lenticular papules have not been observed. It is a dusky erythema, with scattered irregular blotchy underlying macules, purple in colour. The macules persist on pressure in some degree, while the flush fades, leaving the skin very pale by contrast. In severe rashes the macules sometimes appear raised, but cannot be felt. The rash is best seen in the umbilical and epigastric areas, and over the lower ribs. It extends to the sides of the thorax. The distribution of the flush is wider, it is well marked over the trunk, with the exception of the upper part of the front of the thorax, and the hypogastric and iliac areas. It is particularly well seen on the back and between the shoulder-blades. The rash has been seen on the upper and lower limbs, but usually these are not affected. It is not very striking in appearance, and may not be noticed. It fades gradually, the flush disappearing earlier than the macules. As a rule it is no longer visible at the termination of the pyrexia.

The progress of the disease is uneventful. The patient lies quietly, sleeps well, takes his food very well, and does not complain unless questioned. The bowels are not unduly constipated, and diarrhœa does not occur. A slight cough commonly develops, but expectoration is not the rule. One case developed acute bronchitis with much mucous sputum, but this cleared up with the decline of the fever. Pyrexia is continued and high, tending as a rule to rise slightly up to the ninth or tenth day. It may reach 104° F. or more. Remissions in the later stages are usually slight, but large remissions or even intermissions may occur. Intermissions are atypical after the appearance of the rash. The pulse-rate tends to rise a little with the fever, but rarely exceeds 100 per minute.

Termination begins about the tenth day, typically with a slight decline of the fever and clearing of the tongue. A rapid lysis or crisis follows, usually complete in forty-eight hours. Headache abates and hunger returns, and the patient has completely recovered. He is at once ready for food, and states he is perfectly fit. He looks well and cheerful, but is somewhat exhausted, and has lost weight. Four days after the crisis he begins to be up and about, and is fit for discharge to duty a week later.

The above description may be taken as more or less typical. It must

be realized that the rash is faint and easily overlooked. It may be quite absent, as was the case with the children and one adult. The temperature may be irregular throughout, with marked remissions, and severe rigors. The degree of prostration varies greatly. The slow pulse-rate is not so marked in children. Constipation may be troublesome. Catarrhal bronchitis may be severe, and may cause restlessness at night. Fever may be prolonged, and may decline by slow lysis. A streptococcal meningitis has occurred in a doubtful case which has proved fatal.

SEQUELÆ.

One case developed a severe right-sided diaphragmatic pleurisy on the sixth day after the termination of the fever. This was followed by a moderate pleural effusion with prolonged irregular pyrexia. The inflammation then spread to the left pleura. Fever continued and the patient was seriously ill. The pleural fluid proved to be sterile on culture. Convalescence in the remaining cases was uneventful.

LABORATORY FINDINGS.

Blood was taken for culture, and for Widal, Weil-Felix and Brucella group tests in the early stage of all the cases, and except in one case in which blood was difficult to obtain, a second specimen was taken two or three days later. Further specimens were sent at a greater interval. In all cases the results of the Weil-Felix tests were positive for *B. proteus* OXK, except in the doubtful case which proved fatal. The titre varied from 1 : 150 to 1 : 25,000. The Widal results are interesting, often showing a considerable rise in some group, and suggesting the advisability of a routine Weil-Felix test as a control. The blood on culture was negative for enteric group organisms, but coliform and other organisms have been found. The Brucella group tests were negative.

Blood smears taken during the first three or four days after admission invariably proved negative for malaria parasites even in a case developing the disease while under treatment for malaria. Quinine had no effect on the fever. The total and differential blood-counts all indicated a very slight degree of polymorphonuclear leucocytosis. The urine in the early stages was free from albumin and sugar.

Appendix I shows the dates of onset and distribution of the cases. Attention is drawn to the incidence as indicating a ten-day incubation period in the vector.

Appendix II gives a short summary of the cases.

Appendix III is a summary of the serological results.

SUMMARY.

The features of an epidemic of typhus fever (vector unknown) are described.

There is no doubt that the disease is identical with that which occurred in the district in 1932 and 1933.

The disease is not normally transmitted by human contagion and is not of louse origin.

No evidence of transference from an animal by an arthropod vector has been discovered, though this is presumably the case.

The disease appears to be identical with the milder forms of true typhus fever.

APPENDIX I.

Unit	Rank and name	Coy.	Barrack or quarter	Room	Date of onset	Remarks
			KASAULI			
1. R.A.M.C.	Daughter, Sgt. R.	—	M.Q.	—	27.8.34	M.Q. No. 42 Quarter
2. 1st Cheshire	Private S.	D.	No. 4	No. 1	28.8.34	Room uncertain
3. 1st Cheshire	Private B.	H.Q.	No. 1	—	29.8.34	Room uncertain
4. I.A.O.C.	Son, S/Sgt. C.	—	M.Q.	—	29.8 34	Sandringham
9. 1st Cheshire	Private S.	H.Q.	No. 1	No. 2	6.9.34	
10. 1st Cheshire	Private T.	D.	No. 4	No. 2	6.9.34	
12. I.M.S. Director Pasteur Institute	Lieut.-Col. C.	—	"The Firs"	—	7.9.34	Pasteur Institute Estate
13. 1st Cheshire	Private C.	D.	No. 4	Bunk	10.9.34	
14. 1st Cheshire	Private D.	D.	No. 4	—	27.9 34	Room uncertain
16. I.A.S.C...	Son, Sub/Condr. D.	—	—	—	1.10.34	Ravenswood
			SABATHU			
6. 5th Field Bty. R.A. ..	Gunner H.	—	No. 1	—	31.8.34	Room uncertain
7. 3rd Field Bty. R.A. ..	L/Bdr. H.	—	No. 1	No. 6 (upstairs)	2.9.34	
11. 5th Field Bty. R.A. ..	Gunner E.	—	No. 1	No. 1 (downstairs)	6.9.34	
			DAGSHAI			
5. 2nd Lanc. Fus. ..	Drummer S.	H.Q.	—	—	29.8.34	Talheri Camp
8. 2nd Lanc. Fus. ..	Fusilier B.	C.	No. 3	No. 3	2.9.34	
15. 1st East Surrey ..	Private B.	A.	No. 2	—	1.10.34	Room uncertain

APPENDIX II.

Short Summary of the Cases.

Case 1.—Daughter of Serjeant R., R.A.M.C., Kasauli. Aged 10. Quarter, M.Q. No. 42, flat No. 2. The only case in a group of twelve families quite isolated from barracks and the married quarters generally. No history or evidence of tick bite. Onset: about August 27, 1934, but the date uncertain. Admitted August 30, fourth day of disease. Pyrexia, eight days. Termination by two-day lysis. No rash; intermittent fever. Weil-Felix, September 5, second day of convalescence, "OXK" 1 : 7000.

Case 2.—Private S. "D" Company, 1st Cheshire Regiment, Kasauli. Aged 21. In India $4\frac{8}{12}$ years. No history or evidence of infestation. Does not handle animals. Onset August 28, 1934. Admitted September 3, seventh day. Had carried on work after a fashion, going to bed daily

after morning parade. Pyrexia eleven days. Termination by lysis. Slow pulse-temperature ratio. No rash. Weil-Felix, fifth day of convalescence, "OXK" 1 : 6000.

Case 3.—Private B. H.Q. Wing, 1st Cheshire Regiment, Kasauli. Aged 20. In India, $3\frac{10}{12}$ years. No history or evidence of infestation. Does not handle animals. Has not been away from barracks. Works in the garden. Onset August 29, 1934. Admitted August 30, second day. Pyrexia thirteen days. Termination by three-day lysis. Slow pulse-temperature ratio. Rash appeared on fifth day of disease. Well marked and typical. Rigors a feature until appearance of rash. Weil-Felix, last day of pyrexia, "OXK" 1 : 1400.

Case 4.—Son of Staff-Serjeant C., I.A.O.C., Kasauli. Aged 6. Quarter, Sandringham. The only case from a very isolated quarter containing four families. No history or sign of infestation. Onset August 29, 1934. Admitted September 3, sixth day. Pyrexia thirteen days. Termination four-day lysis. Pulse-temperature ratio, slow for a child with fever. No rash. Weil-Felix, fourth day of convalescence, "OXK" 1 : 4000.

Case 5.—Drummer S., H.Q., 2nd Lancashire Fusiliers, Dagshai. Aged 24. In India, $5\frac{6}{12}$ years. Quarter, Talheri Camp since August 5, 1934. Camp infested. Patient badly bitten on the legs. Bites became septic but had disappeared on admission. Patient did not know what bit him. Onset August 29, 1934, at Talheri. Felt very ill on August 31, but walked back to Dagshai. Admitted September 3, sixth day. Remained in bed during the interval. Pyrexia thirteen days. Termination critical. Slow pulse-temperature ratio. Rash was well-marked on the seventh day and was present on transfer to Kasauli on the tenth day. Weil-Felix, second day of convalescence, "OXK" 1 : 600.

Case 6.—Gunner H. 5th Field Battery, R.A., Sabathu. Aged 22. In India $\frac{8}{12}$ years. No history or evidence of infestation. Does not handle animals. Has explored the hills all round Sabathu both on and off duty. Onset August 31, 1934. Symptoms typical. Admitted September 2. A "faint rosy rash" is noted on abdomen and sides of chest on ninth day of disease. This had faded so as to be unrecognizable on transfer on the eleventh day. Pyrexia thirteen days. Termination by crisis. Slow pulse-temperature ratio. Headache and lassitude a feature. Recovery very complete. Weil-Felix, fifth day of convalescence, "OXK" 1 : 25000.

Case 7.—Lance-Bombardier H., 3rd Field Battery, R.A., Sabathu. Aged 25. In India $3\frac{6}{12}$ years. No history or evidence of infestation. Arrived Sabathu about August 15, 1934. Explored the surrounding hills daily. Onset September 2, 1934. Admitted September 5, fourth day. Pyrexia fourteen days. Terminated by four-day lysis. Slow pulse-temperature ratio. Rigors and large remissions a feature. A fading rash present on transfer to Kasauli on tenth day of disease. Weil-Felix, second day of convalescence, "OXK" 1 : 500.

Case 8.—Fusilier B. 2nd Lancashire Fusiliers, Dagshai. Aged 22. In India $1\frac{11}{12}$ years. No history or evidence of infestation. Fond of

walking. Long treks from morning till night on Thursdays and Sundays. Much in the grass of the hill sides. Onset September 2, 1934 (or perhaps one day earlier). Admitted September 5, fourth day of disease. Transferred to Kasauli as acute rheumatic fever, September 9, eighth day of disease. Pyrexia eighteen days. Termination by lysis from fourteenth day. Slow pulse-temperature ratio. Rash present on transfer, eighth day of disease. Placed on seriously-ill list on fourteenth day of disease. Bronchitis a feature, but not severe. Headache very severe. Recovery complete. Weil-Felix, fourteenth day of disease, "OXK" 1 : 1400.

Case 9.—Private S. H.Q., 1st Cheshire Regiment, Kasauli. Aged 18 years. In India $1\frac{8}{12}$ years. Bitten fourteen days before onset behind the right ankle. Mark present but unidentifiable on admission. No other evidence of infestation. Walks on the hill sides daily through the grass. Onset September 6, 1934. Admitted September 10, fifth day of disease. Pyrexia thirteen days. Termination by crisis. Rigors a feature and pyrexia accordingly somewhat atypical. Slow pulse temperature ratio. Headache severe. Rash present on admission, fifth day of disease, typical and well marked. Weil-Felix, second day of convalescence, "OXK" 1 : 5000.

Case 10.—Private T. "D" Company, 1st Cheshire Regiment, Kasauli. Aged 25 years. In India 5 years. No history or evidence of infestation. Never leaves the barracks, exercising on the sports ground. Does not handle animals. Onset September 6, 1934. Admitted September 12, seventh day. Managed to carry on by going to bed after the midday meal each day before admission. Pyrexia. There was a crisis on the twelfth day, but slight fever continued for a further two days. Low pulse-temperature ratio. Headache and slight rigors a feature. Very typical. Rash absent. Weil-Felix, fourth day of convalescence, "OXK" 1 : 7,000.

Case 11.—Gunner E. 57th Field Battery R.A., Sabathu. Aged 24. In India $5\frac{10}{12}$ years, September 3, 1934, admitted for malaria benign tertian relapse. September 6, onset of specific fever, while in hospital. On leave in Sabathu. Much out on the hills and accustomed to go fishing frequently. No evidence or history of infestation. Keeps a dog. Pyrexia fourteen days. Critical termination. Slow pulse-temperature ratio. Headache, rigors and severe prostration. Rash present and well marked on transfer to Kasauli; sixth day of disease. Much faded by the eleventh day. Complicated by a slight catarrhal bronchitis. Placed on seriously-ill list September 18, eleventh day of disease. Weil-Felix, thirteenth day of pyrexia, "OXK" 1 : 400.

Case 12.—Lieutenant-Colonel C. Director, Pasteur Institute, Kasauli. Aged 46. In India 20 years. History of having been bitten by something a few days before onset. A severe rash, simulating herpes zoster, present in the right lumbar region, intensely itchy and painful. This extended forward to the abdomen, and appeared to be a true herpes. The patient, a great gardener and out-door worker, is fond of exploring the hills and sitting in the grass. Keeps a dog, which he grooms daily. Onset September 7, 1934, with headache. Rigors followed, and were a feature

throughout. Gave up work on September 10. Treated in quarters. Admitted September 14, eighth day. Pyrexia thirteen days. Chart atypical, fever very intermittent. Headache was intense, and twice daily rigors were a feature, rash present and typical on admission, but slightly faded. Weil-Felix, maximum, 1:700 for "OXK." Sequelæ, sixth day of convalescence, severe right-sided diaphragmatic pleurisy, and low continued fever. The pleurisy was followed by effusion. It continued to spread, and the patient was seriously ill.

Case 13.—Private C. "D" Company, 1st Cheshire Regiment, Kasauli. Aged 42. In India 12 years. Storekeeper. Handles coir, thinks he might have been bitten by insects in the coir. Never leaves the barracks. No history or evidence of infestation, a severe and typical case. Dangerously ill towards the termination. Acute bronchitis a complication. Recovery complete. Onset September 10, 1934. Fever gradually rose to a maximum of 104° F. on the tenth day. Crisis on twelfth day. Normal pulse-temperature ratio throughout. Rash appeared on fifth day, well marked flush. Weil-Felix, eighth day of convalescence, "OXK" 1:3,500.

Case 14.—Private D. "D" Company, 1st Cheshire Regiment, Kasauli. Aged 22. In India $4\frac{10}{12}$ years. No history or evidence of infestation. Keeps a dog, but states it has no vermin, as he washes it three times a week. Much on the hill sides and in the grass on company training during the month of August. Onset September 27, 1934. A "textbook" case. Rising continued pyrexia with slight remissions to ninth day. Thereafter slight defervescence with termination by crisis on twelfth day. Very low pulse-temperature ratio. Headache marked. No rigors. Recovery remarkably complete. Rash appeared on fifth day of disease. Weil-Felix, last day of pyrexia, "OXK" 1:1,400.

Case 15.—Private B. "A" Company, 1st East Surrey Regiment, Dagshai. Aged 25. In India $4\frac{10}{12}$ years. States his barrack room at Dagshai has "thousands" of bugs, and his bed is full of them. No other history and no sign of infestation. Never handles animals. A great runner, he practices for an hour nearly every day, often runs through grass. His distance is three miles. Onset October 1, 1934. Admitted October 2. Pyrexia nineteen days. A severe case, complicated by slight bronchitis. Seriously ill. Mental condition peculiar throughout, appeared to suffer from slight delusions. Termination by lysis fourteenth to nineteenth days. Pulse-temperature ratio slow. Rigors and marked remissions a feature for the first ten days. Rash, typical and marked. Observed fifth day of pyrexia. Weil-Felix, October 9, ninth day, "OXK" 1:125.

Case 16.—Son of Sub-Conductor, I.A.S.C., Reginald D. Aged 5. A doubtful case. Admitted with slight diarrhœa on the seventh day of disease. No history or sign of infestation. Onset October 1, 1934. Twenty-one days pyrexia, terminating in death from acute streptococcal meningitis. Weil-Felix, eighth day, "OXK" 1:50. On the thirteenth day, specimen proved too small to test. Fourteenth day, negative results from cerebrospinal fluid. Thereafter very ill and investigations not continued.

APPENDIX III.—SUMMARY OF SEROLOGICAL RESULTS.

B. proteus OXK 1 in :—

Case No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	DAY OF ONSET
1										7000														
2									350			2800				6000								
3					Neg.	Neg.		80					1400											
4										120							4000							
5										50					500					380				
6								Neg.			600	2000						25000						
7									Neg.	50						600								
8									100		550			1400									1000	
9							100		500						5000									
10								500		2500									7000					
11					Gm.	Neg.		50					400											
12									700															
13																				3500				
14						100						1400												
15						35		125											175					
16								50													+			

│ to │ = Febrile period in British Military Hospital, Kasauli.

{ to │ = Febrile period in other Military Hospital before transfer to Kasauli.

BOOT LEATHER: WITH SPECIAL REFERENCE TO THE TROPICS.

By Major H. W. FORRESTER.

Chief Inspector of Stores and Clothing, Ordnance Services Directorate, Army Headquarters, India.

In the Journal of the Royal Army Medical Corps there have appeared from time to time articles on the design and construction of Service footgear, but little or nothing appears to have been said regarding the materials of which the Army boot is made. This short note is an attempt to repair the omission.

Boots and shoes worn for general utility purposes are nearly always made of leather which has been chrome tanned, or vegetable tanned.

Chrome tanned leather is almost universally used in the manufacture of all portions of civilian boots and shoes, the soles excepted. For the latter, leather prepared by the old process known as vegetable tanning continues to be employed.

In vegetable tanning the skin of the animal (or, to use the trade name, the "hide") is soaked, washed and placed in a solution of lime for a week. It then has the hair and fat removed by scraping, and is delimed in a weak acid, such as boric or lactic. After this it is passed through a succession of pits which contain the tanning liquor, a strong cold infusion of oak, babul, or other bark and myrabalan nuts. The liquor in these pits gradually increases in concentration or specific gravity, so that the hide begins with the weakest and finishes with the strongest. After about five months of such treatment the hide is tanned and becomes leather in the crust state. It is then reduced to a uniform thickness and thereafter curried. Currying is the process by which the moist leather has dubbin rubbed into it. The dubbin is a composition of tallow and fish oil. Next, the leather is polished on the grain side and finally allowed to mature.

In chrome tanning the methods adopted are quite different. The hide, after passing through the liming stage, is treated with chromic acid or chrome alum. It is then pickled in a bath of salt and hydrochloric acid, or aluminium sulphate and sulphuric acid. It may also be treated with sodium thiosulphate or certain other chemicals—depending on the class of leather required or the special formula employed in any particular tannery. After tanning the leather is treated with oil to give it the requisite softness and flexibility.

In some chrome tanneries a single bath is used; in others, a double bath method is employed; but variations such as these depend on the particular trade class of leather which it is desired to turn out.

The outstanding characteristics of chrome-tanned leather are a high

tensile strength, flexibility, and imperviousness to water. The preparatory process may be counted in hours, that of vegetable tanning in the same number of weeks. Although in chrome tanning the necessary chemicals are comparatively expensive, the whole process is somewhat cheaper than vegetable tanning. Besides, as chrome leather does not need to be dubbined, its storage is easy. Chrome leather has not yet replaced vegetable-tanned leather for a number of important uses besides that of soleing boots. Vegetable-tanned leather is still found to be the more suitable for such purposes as machine belting, harness, saddlery, hydraulic washers, etc.

So much for manufacture; what is the position as regards wear?

In a temperate climate boots with chrome leather uppers can be worn without undue discomfort; but, in a tropical climate, these boots are far from comfortable. To use an expressive phrase, they "draw the feet." In other words, in the inside of the chrome leather boot there is a comparatively high degree of humidity.

Analysis of chrome leather shows that there are no free chemicals in quantity sufficient to cause harm to the skin of the foot; and when shoes made from chrome leather are worn, the "drawing" effect complained of when boots are worn is not noticed.

From this it might be thought that the high humidity is due merely to defective ventilation in the interior of the boot. Naturally, in the case of shoes, ventilation must be more efficient. However, it is found that boots made of vegetable tanned leather are cooler to the feet than those made of chrome leather, and that this comparative coolness is not due to any superior ventilating qualities possessed by the former type. Practically speaking, vegetable tanned and chromed leathers are to all intents and purposes air-proof. Hence, it is not a question of simple ventilation.

Experiments show that, as compared with vegetable-tanned leather, chrome leather has a high initial absorption rate for water and watery vapour, but that, in a short time, this rate rapidly diminishes, and eventually becomes very slow. The absorption rate of vegetable-tanned leather is not only good, but nearly constant.

The practical results of these differing qualities are that, in the case of chrome leather, after a certain time has elapsed perspiration remains penned up in the boot; while, in the case of vegetable-tanned leather, after the same period and under the same conditions perspiration continues to pass through the leather to the outer air, where it is dried off by evaporation. Evaporation results in cooling, and this cooling effect is transmitted to the wearer's feet. By contrast, the water-logged chrome leather produces a vicious circle by raising the interior temperature, increasing perspiration and causing the socks and the skin to become permanently sodden.

Perhaps it is not strictly, and certainly not scientifically, correct to say that there is no ventilation in the interior of a boot. In walking, the movements of the feet in the boots must displace, outwards and inwards, a greater or lesser quantity of air at every step taken. Even with rubber

boots a certain amount of this kind of ventilation takes place. But in the case of rubber resistance to the penetration of moisture in any form is absolute ; there is no evaporation from the outer surface, hence no cooling effect, and internally there is a permanent state of humidity over saturation point.

It might be possible, by the provision of air ducts leading from the top edge of the uppers to below the instep, greatly to improve ventilation ; but it is doubtful if ever a sufficient quantity of air could be provided to render ventilation anywhere near perfection. Still, that is a constructional problem which might be worth trying out, at least in the case of chrome leather boots.

In India, the Army boot is made of vegetable-tanned leather. At home, chrome leather boots are accepted from the manufacturers up to 50 per cent of the contract. Both at home and abroad troops prefer the chrome leather variety because the boots, not having been treated with dubbin, look neater, cleaner and take a polish more easily. In India, the dislike of the dubbined boot is accentuated on account of the fact that the flesh side of the leather is on the outside. So, in deference to the spick and span spirit, the leather is often deprived of its grease by means of injurious chemicals, and a wax polish is applied which fills the grains, acts as a waterproof varnish, hinders the passage of moisture, and thus destroys the cooling effect of evaporation. Thus is efficiency sacrificed for the sake of appearance. However, it should be added that this undesirable practice is less common now than it used to be.

From the above we may conclude that, for tropical climates, the most satisfactory boots are those made from vegetable-tanned leather which has been treated with dubbin, and which has not been ruined because of a desire to secure a polished surface ; that chrome leather boots are not suitable ; and that rubber boots are definitely and markedly unhygienic.

Editorials.

THE TYPHUS GROUP OF FEVERS.

The typhus group of fevers is much discussed at the present time. The tabular classification of the group here given differs from that adopted in some of the recently-published books and is based primarily upon the work of Felix on the serological reactions of the typhus fevers.

Until quite recently it was considered that typhus fevers could be classified on a vector basis. New work renders the vector basis an unsatisfactory one and we consider that at present the only classification that rests upon a scientific basis is the one based on the antigenic structure of the viruses of the typhus group. This, the simplest classification, is thus in three groups in which the antigenic types of the virus are (i) X19, (ii) XK, (iii) undetermined.

It would be advantageous if the use of the terms louse, tick, and mite typhus were discontinued until such time as the vector problem is more clearly understood.

We are indebted to Dr. Felix for permission to include in the following table the results of both his published and unpublished work upon this group of diseases.

Typhus Group of Fevers.

Subgroup ..	Type X19	Type XK	Type undetermined
Name of disease ..	*Classical epidemic typhus* Tabardillo endemic typhus (Brill's) of U.S.A. and Australia, Greece, Syria, Manchuria, Malaya (shop typhus) and Toulon (fièvre nautique)	*Japanese river fever* (Tsutsugamushi fever of Japan, Malaya and Dutch East Indies) Malay scrub typhus Scrub typhus of East Indies	*Spotted fever of Rocky Mountains* San Paulo endemic typhus Fièvre boutonneuse Febbre errutiva Tick bite fever of S. Africa India tick typhus
Vector	Lice and rat fleas	Mites	Ticks
Reservoir of virus	Rats Man	Field mice and rats	Rodents Dogs ? Ticks
Agglutination ..	X19 +++ X2 + XK –	X19 – X2 – XK +++	X19 + X2 + XK +

SURGERY OF THE CHEST.

PROBABLY more remarkable advances have been made in the surgery of the chest during the last twenty years than in any other region of the body.

The Great War had its influence on this progress, and the chest was opened frequently for the removal of foreign bodies. Pierre Duval of the French Army did much pioneer work and demonstrated how simple it was to deliver the lung, or part of it, outside the thoracic cavity and by palpation detect and remove fragments of metal lodged in the lung.

For many years surgeons were deterred from operations involving wide opening of the pleural cavity owing to the serious consequences of a large opening in the chest wall, which by upsetting the normal negative pressure in the pleura induced the dangerous condition of mediastinal flutter from the lack of support on one side.

In war wounds when a large open sucking wound of the chest wall has occurred, prompt closure by suture or packing and strapping causes immediate improvement in the condition of the patient.

When serious operations in the chest were first attempted it was considered essential to have an air-tight chamber in which the operation was performed. By means of a pump a negative pressure was maintained. The surgeons and assistants were inside the chamber and the anæsthetist outside, the patient's head projecting through an air-tight opening in the wall of the room. To prevent a negative pressure in the abdomen and lower extremities these parts were enclosed in a bag communicating with the outer air.

Such elaborate arrangements, rarely available, put a serious limitation on the amount of chest surgery that could be done.

These have now been replaced by the method of intratracheal insufflation carried out by a tube introduced through the glottis by means of which the anæsthetic vapour can be administered at varying pressures.

This method is now widely practised for all types of surgical operation and is valuable for operations on the head and face, mouth, and nasal passages, but especially for conditions where a wide opening is made in the chest wall. At the finish of a chest operation the pressure is increased before the chest wall is closed so as to re-expand the lung on the affected side.

Tubercle of the lung was up till recent years regarded as outside the province of the surgeon. The first surgical procedure introduced into the treatment of tubercle of the lung consisted in the production of an artificial pneumothorax; this valuable method has now become the province of the physician. Next, or about the same time, the surgical procedure of

avulsion of the phrenic nerve was practised. Both these methods have for their object the putting of the diseased lung at rest so as to facilitate healing of the lesion. Both are valuable, but at times they failed to procure the results hoped for owing to adhesions in the pleura preventing the collapse of the lung taking place; or in cases of phrenic avulsion because the lower lobe only was affected whereas the diseased area was frequently the apex. Operations to cause collapse of the bony walls of the chest, often of considerable magnitude and involving two or three stages, were also employed.

Next, methods to place the diseased apex of the lung at rest by carrying out a local collapse of the diseased area, often containing a cavity, were brought into use. The great advocate of this method is Professor Sebrechts of Bruges.

The whole operation in these cases is extrapleural. After resection of a rib the parietal pleura is stripped off the inner side of the chest wall and some substance introduced between the chest wall and the pleura to maintain pressure on the diseased apex of the lung. Fat has been used for this purpose and paraffin has also been employed. These procedures often failed to maintain the obliteration of the cavity; suppuration and sinuses were common.

Hence Sebrechts introduced his method of making a pad of the pectoral muscles which were freed from the chest wall, but left with their vascular and nerve connections. This pad was packed inside the chest wall extrapleurally and the wound completely closed.

The operation is one of considerable severity in patients who are seriously ill from tubercle of the lung, but in the hands of Sebrechts it has yielded good results and he is able to show a long series of patients who have undergone this operation, in some cases on both sides, and who have been restored to full working efficiency.

With increasing experience of intrathoracic surgery, expert surgeons have gradually been led to perform still more drastic operations, and in the current number of *The British Journal of Surgery* Tudor Edwards and C. Price Thomas describe their work for the cure or alleviation of bronchiectasis by the operation of lobectomy carried out in one stage.

The article points out that bronchiectasis is a disease which medical treatment can only palliate, that the disease steadily advances, and although patients who have suffered from long-continued infective processes are poor subjects for operation, lobectomy promises more than medical treatment for these patients.

The authors discuss the various surgical methods which have been adopted to deal with bronchiectasis, dividing the subject into (1) the collapse methods, including artificial pneumothorax, phrenectomy and thoracoplasty, and (2) the radical methods for extirpation of the diseased tissues.

Regarding artificial pneumothorax they point out that it rarely succeeds

in collapsing the thickened dilated brcnchi. Oleothorax is claimed to give slightly better results. Phrenectomy may cause some improvement in early cases. Of the radical operations, cautery pneumectomy as described by Graham is considered unsatisfactory in bronchiectasis unassociated with large cavities.

They think the one-stage lobectomy for bronchiectasis to be the ideal when a single lobe is involved, and consider that operation will cure the patient if he survives it and the immediate post-operative period.

The mortality from the two-stage operation is very high, amounting in Lilienthal's cases to 64·3 per cent.

The one-stage method was first tried by Brunn, and later by Shenstone.

Regarding the indications for operation it is essential to ensure that the disease is localized to one lobe, or to the lower and middle lobes on the right side.

In an operation of such severity the operative mortality and final results are of great interest.

In a series of forty-eight consecutive cases : the right side was affected in fourteen ; one case had both sides involved, and the remainder were left-sided. The oldest patient was 49, and the youngest 9 years of age. Of these forty-eight cases seven died subsequent to lobectomy, four within the first week, and three later. Of those who died at the later periods, two had tubercle which was not suspected—one death resulted from cerebral abscess. Thirty-five patients have been discharged from hospital for periods varying from five years to a few weeks. Six patients have some residual symptoms, but much diminished by the operation. One patient now expectorates 60 to 90 cubic centimetres of purulent sputum daily compared with 360 to 560 daily before operation. Twenty-nine patients are healed and symptomless.

It seems clear that in the hands of an expert lobectomy in suitable cases holds out reasonable hope not only of survival but of cure in a large proportion of the cases.

While this is so, it would appear to be an operative method which should be only undertaken by those with special experience of this type of surgery, in perfect surroundings, and with a skilled team of assistants, and a skilled anæsthetist.

Clinical and other Notes.

NOTES ON A CASE OF UTERINE FIBROMYOMATA COMPLICATING PREGNANCY.

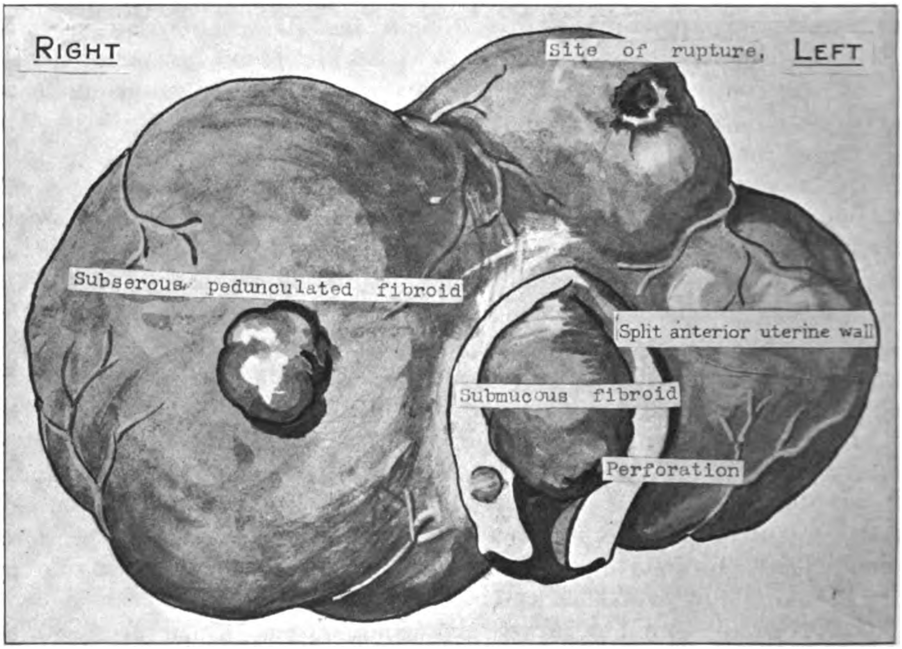
By Major C. F. BURTON, M.C.,
Royal Army Medical Corps.

Mrs. W., an apparently healthy woman, aged 35, was married in March, 1934. Menstruation had been regular with no excessive loss, and a normal period occurred on June 2, 1934. This was followed by uncomplicated amenorrhœa until the sudden onset of free uterine hæmorrhage with abdominal pain on September 16, 1934. Admitted to hospital on the following day, the patient passed a fœtus of approximately fourteen weeks development, the placenta being retained. There was a three weeks' history of obstinate constipation. Temperature 100° F., pulse 100. A tense irregular abdominal swelling, approximately the size of a twenty-eight weeks pregnancy, was discovered; and a displaced os uteri was found to be sufficiently dilated to allow what appeared to be retained products of conception to be palpated. Loose placental debris was removed and an intra-uterine douche attempted. The case was transferred to the Military Families Hospital, Woolwich, on September 18, 1934. Temperature 100° F., pulse 120. On examination under "evipan sodium" anæsthesia on September 19, 1934, a diagnosis of infected incomplete abortion with uterine fibromyomata was made. A general anæsthetic was administered the following day and the uterus explored with ring forceps and the finger. Portions of retained placental tissue were removed with difficulty from behind a large submucous fibroid, which occupied the greater part of the uterine cavity. No douche was given. It was decided to deal with the abdominal tumour at a later date. The condition of the patient failed to respond to the accepted methods of treatment and signs of a severe infection developed, which, with the onset on September 26, of acute abdominal pain, most marked over the left hypochondrium, diarrhœa, and vomiting, became grave. Peritonitis was diagnosed and the abdomen opened the same evening by Mr. Arnold Walker, Consulting Gynæcologist to the hospital. A quantity of free thin pus was evacuated, and the tumour consisting of multiple fibromyomata—one of which had ruptured into the peritoneal cavity—removed by hysterectomy. The pouch of Douglas was drained by tubes through the abdominal wall and per vaginam. After an anxious forty-eight hours the patient made a complete recovery complicated only by a mild *B. coli* urinary infection.

A blood-culture, taken on the morning of September 26, 1934, proved

sterile after forty-eight hours, while an intra-uterine swab taken at the same time gave a growth of coliform bacilli only. The tumour weighed four pounds and the uterus contained a submucous fibroid, the size of a hen's egg, the lower pole of which had been perforated. The following extract is taken from the pathological report by Major R. N. Phease, R.A.M.C. :—

"Uterus involuted and showing subserous interstitial and submucous tumours. On section the largest tumour is firm and hyaline, others show central softening and necrobiotic changes. Sections show tumours to be fibromyomata most of which have undergone advanced hyaline degeneration.



One tumour ruptured. Sections show some degree of round-celled infiltration but no evidence of bacterial infection."

The features of the case appear to be:—

(1) The occurrence of pregnancy in a uterus already occupied by a submucous fibroid and the development of a fœtus measuring approximately 3½ inches.

(2) No clinical evidence, prior to abortion, of an abdominal tumour which must have been present for some years.

(3) The similarity, to the examining finger, of a degenerating intra-uterine tumour to retained products of conception, and the consequent dangers of any drastic measures for removal.

(4) The doubtful origin of the "septicæmic state." *B. coli* was isolated from the uterine cavity and later from the urine, but there was no evidence of other pathogenic organisms.

(5) The typical degeneration of the tumours and its advance in the presence of pregnancy.

(6) The question as to whether the rupture of the fibroid, giving rise to peritonitis, was due to infection or was mechanical. It is worthy of note that the point of maximum tenderness over the swelling corresponded to the site of rupture. The symptoms of peritonitis did not follow examinations nor were the pathological findings suggestive of infection at the site.

(7) The possible traumatic cause of the perforation of the intra-uterine tumour and its effects, if any.

(8) Mechanical constipation with the progress of pregnancy and the enlargement of the tumour.

(9) The involution of the uterus.

My thanks are due to Mr. Walker for his valuable assistance and to Colonel B. H. V. Dunbar, D.S.O., late Assistant Director of Medical Services, Home Counties Area (West), for permission to send the case for publication.

A MIXED BAG.

Comments on a Series of Cases met with in Routine Work.

By Captain C. F. J. CROPPER,

Indian Medical Service.

Most medical officers have a periodical grumble about the paucity of good clinical material in military work—and I among them. But during April, May and June of last year such an unusual assortment of cases came my way that not only have I ceased, *pro tem.*, to grumble, but I am tempted to wonder whether they are not worth recording, and whether one's mistakes are not too puerile to be instructive.

Perhaps I should mention that the appointment in which I met with these cases is that of Resident Medical Officer in the Lawrence Royal Military School, Sanawar, in the Simla Hills. Many readers of the Journal will not have heard of this School, especially those who have not read "Kim." Briefly, it was founded by Henry Lawrence, of Lucknow fame, in 1847. He was so appalled by the lack of provision for the soldiers' children in the barracks of those days that he was determined to establish a school in which the British soldier could, by payment of a small fee, educate and provide for his children whilst in India. Lawrence gave Rs. 80,000 from his own pocket and, in spite of an almost superhuman busy official life, launched the School with a constitution complete even to meticulous details. It is now (apart from the fees charged) maintained from the Army Budget, and is known throughout India. There are 550 children distributed through a Boys' Section, a Girls' Section, and a Pre-

paratory Department, the School being run on military-cum-public-school lines. From the medical point of view, it presents a large and interesting field, there being some 700 Europeans and 650 Indians in the hill-top Colony. In the summer the Surgical Specialist and Dental Officer are available at Kasauli, three miles distant, but in the winter it is rather like being on a desert island.

Lawrence, by good luck or with remarkable foresight, choose a spot free from practically all the tropical diseases, the summer temperature seldom rising above 98° F.

Taken all round, the appointment is among the most interesting of all the junior posts open to Indian Medical Service officers.

So much for a preamble. Now for the cases, which are given in the order in which they occurred. The writer is not under the delusion that the cases or the methods of treatment are very remarkable. Having spent most of his previous service in charge of Brigade laboratories, he had in consequence had little surgical experience. Comments from readers of this article on any of the lines of treatment mentioned will be all the more welcome, should they care to write to the address given.

European Cases.

(1) Acute maxillary antrum (female, aged 33). A straightforward case, quite unrelieved by medical measures. No anæsthetic effect was produced by 5 per cent cocaine, so puncture was done under general anæsthesia. Pus immediately welled up out of the cannula. I was a little nonplussed on finding that the antrum could not be washed through—presumably the ostium was occluded. Slight relief succeeded the operation. Later the antrum was washed out more successfully, and the case recovered completely.

(2) Chronic maxillary antrum (female, aged 10). History of six years' nasal trouble—right nostril constantly blocked with mucopus. Months of nasal douching had failed to alleviate. It is said that the commonest cause of a chronic discharge of this kind is a foreign body in the nasal passages, but exploration yielded a negative result.

I decided to put the antrum into the dock, and do a diagnostic wash-out. It is a sad but true fact that one can imagine one has got into the antrum and not be in it at all. This happened to me twice. To make sure, I sought the advice of someone with more experience than I had. He demonstrated the unusual thickness of the antral wall in this child by showing that quite a heavy blow with the palm of the hand on the handle of the trocar was necessary to cause perforation. Weekly wash-outs (using 20 per cent. cocaine and 1:1,000 adrenalin in equal parts, and 1:60 Dakin's fluid) are producing definite pus (half a drachm or so) and definite improvement.

(3) Oriental sore (male, aged 8). Infected in Quetta. Typical sores on the forehead and on the tip of nose. This patient, through the kindness

and interest of Lieutenant-Colonel H. E. Shortt, I.M.S., was one of the first to be treated by the new Leishmania vaccine. After the third injection, the sores dried up. Five injections in all were given. The sore on the nose is now showing signs of relapsing.

(4) Fractured base (male, aged 10). Fell on to his head from a height of twelve feet, whilst clambering on to the roof of a building. The main symptom took the form of fairly profuse hæmorrhage from the left ear. Apart from a little slowing of the pulse and a semiconscious condition lasting for four hours, with deafness in the affected side for two days, there were no further signs or symptoms. The tympanum was intact.

(5) Brachial neuralgia (female, aged 11). Acute tenderness over the ulnar nerve where it grooves the humerus, and for seven inches below in the course of the nerve. Tenderness spreading to the axilla on the fifth day. No paresis but slight anæsthesia over the skin distribution of the nerve. There was nothing whatever found to account for the condition. There was no palpable glandular enlargement, no obvious septic focus, no cervical rib. The neuralgia cleared up after eighteen days' treatment consisting of hot applications and gentle massage.

(6) Urticaria (female, aged 33). A history of similar attacks periodically for ten years, invariably as the sequelæ of some lowering illness. On this occasion the attack followed one of acute bacillary dysentery, after an interval of three weeks. Its features were: (1) Pyrexia of 103·8° F. for four successive evenings; (2) universal blotchy rash, slightly raised and exceedingly irritating; (3) œdema of the face and suffusion of the conjunctivæ.

The patient had been ailing for three days before the rash came out, and I mistakenly diagnosed measles, the patient not divulging her previous history, except that she "had had measles four times." (How hard to steer between the determination not to be hide-bound by the textbook and one's faithfulness to the traditional maxims of medicine!)

In all there were four attacks, the intervals being fourteen, seven and five days respectively, and the attacks diminishing in intensity. The second attack was cut short by a hypodermic of adrenalin; I shall try a hypodermic of collosal calcium next time. As regards prophylaxis, I have not been able to incriminate any particular article of diet.

(7) Perinephric abscess (female, aged 43). Eighteen months previously this patient had had an acute *B. coli* pyelitis. The onset of the present attack was characterized by vomiting and epigastric pain. The tongue was thickly furred, and the temperature ranged between 99° F. and 101° F. On the third day, the vomiting stopped and the pain settled in the epigastrium and over the descending colon, which was palpably thickened. There was slight pyuria.

On the tenth day the spleen appeared to be enlarged below the costal margin. Symptomatic treatment and alkalinization of the urine were carried out. The pus in the urine diminished but did not disappear.

Thereafter the pain began to spread towards the left lumbar region, and on the thirteenth day a definite fulness of the loin was apparent.

The following morning the urine was loaded with pus, and the total white count proved to be 35,000.

The case was sent to the Kasauli Families Hospital where operation revealed a *B. coli* perinephric abscess.

This case demonstrates: (1) The importance of doing a total white count at an earlier stage, and (2) the ease with which a perinephric abscess can be mistaken for the spleen. (The serum was actually sent for Widal and Weil-Felix tests.) The patient being in quarters, the white count could not readily be carried out (no excuse, I admit!), and as regards the nature of the tumour, no band of colonic resonance nor any posterior dullness were demonstrable, though it is true that the tumour was not "notched."

(8) Osteo-arthritis of the spine (male, aged 30). This is a case of eight years' standing. The patient is half crippled by the spinal condition, and by muscular rheumatism, especially in the tendons of the adductors of the thigh. The X-ray picture shows the case to be a true "bamboo spine." The patient has spent much money on spa treatment without any effect. During the period under review I started him on a course of Warren Crowe's vaccine, as detailed in "Handbook of the Vaccine Treatment of Chronic Rheumatic Diseases."

My enthusiasm for this vaccine arose from a series of visits to Dr. Crowe's Clinic in Crosby Row, near Guy's Hospital. His results with the chronic rheumatic diseases, notably rheumatoid arthritis, are very remarkable indeed.

The case in question is reacting satisfactorily, so far as the muscular pains are concerned. Two other cases of chronic rheumatism are also under treatment, with very striking results.

(9) Ovarian insufficiency (patient aged 28). Symptoms of increasing stoutness and drowsiness, abnormal growth of facial hair, headaches and amenorrhœa, the last dating from the beginning of 1933. During the autumn of that year, she had taken ovarian compound which had restored the periods. Later on hormotone had been prescribed, without effect. The patient had been put back on to ovarian compound for two months, but the amenorrhœa persists. The other symptoms are less prominent. The case is not suggestive of pituitary tumour.

The condition, in its more severe form, dates from the last pregnancy.

(10) Spasmodic dysmenorrhœa (patient, unmarried, aged 29). It is a curious fact, and one very difficult of explanation, that the majority of European women in the community under consideration suffer from some kind of menstrual abnormality, ranging from a marked decrease in the interval to complete amenorrhœa. Return to sea-level acts like a charm. Is it dependent on the height? My experience of other hill-stations is insufficient to judge.

The case in question had, actually, nothing to do with local conditions: the dysmenorrhœa dated from the beginning of her menstrual life. "Liquor Sedans" and sodium salicylate were severally tried, both being given for eight days before the periods were due. I cannot say that either had much effect.

The patient is highly-strung, and so far is unwilling to have a dilatation performed.

INDIAN CASES.

(1) Cutaneous neurofibromatosis (female, aged 30). Multiple painful nodules along the course of the cutaneous nerves of the arms, about the size of a millet-seed. Duration three years. The case was lost sight of.

(2) Intramammary abscess (patient aged 19). A case of bilateral intramammary abscess a month after confinement. The abscesses were extremely refractory to treatment, the whole duration of the case being six weeks.

No tubercle bacilli were found in the pus.

(3) Epithelioma penis (patient aged about 35). This case, which came from a neighbouring Hill State, was suffering from a fungating epithelioma of the penis, with advanced secondary infection and a urinary fistula at the root of the organ. The testicles, part of the scrotum, and the penis with the urethra down to the superficial layer of the triangular ligament, were removed. So much difficulty was found in producing hæmostasis, that it was decided not to remove the crura. A catheter was tied in in the usual way, and the patient made a good recovery with no incontinence.

(4) Three cases of internal piles (males). These were all treated by weekly injections of 5 per cent phenol in almond oil. Two of them are clearing up nicely. The third, who had a severely prolapsed pile, did not improve at all.

(5) Pernicious anæmia (female, aged 31). Diagnosed at first as secondary anæmia due to pyorrhœa, this case (a purdah woman who refused to come to hospital) turned out to be a straightforward case of pernicious anæmia, with total red cells 1,600,000, and polymorphs 75 per cent. Of the classical symptoms she showed oral sepsis, great weakness, dyspepsia and diarrhœa, palpitations, œdema of the ankles and fever.

The blood contained megaloblasts.

She started to pick up after less than a week of liver treatment.

(6) Abdominal abscess (female, aged 27). History of three abortions in three years, the most recent being a year ago, since when periods had been normal. Had been suffering from malaise, fever and abdominal pain for six weeks.

On inspection, the patient was found to have an abdominal tumour exactly resembling a four-months' pregnancy, except for some lateral shading-off of the swelling. The tumour had been noticed by the patient for only ten days. It increased in size daily after her admission. Her temperature swung from 99° to 102·5° F. daily.

I rashly jumped to the conclusion that it was a case of chorion-epithelioma, and prepared for a total hysterectomy. Here, again, a total white-cell count would have saved me from error. Barely was the peritoneum incised before a copious stream of pus welled up from within the tumour. One upper and two lower drainage tubes were left in, and the cavity washed through daily with Dakin's solution.

The origin of the abscess is a matter of guesswork: I suppose the appendix is the most likely. The abscess was not attached to the uterus. The laboratory finding on the pus was streptococci in pure culture. The patient, who was greatly emaciated on admission, is recovering steadily, with no further pyrexia.

(7) Amputation of digits (male, aged 19). This case (that of a coolie involved in a blasting accident) illustrates the truisms that in this type of trauma the damage is always more extensive than appears on the surface, and the classical amputation incision generally has to give place to a trimming-up on lines of common sense.

The first three digits of the left hand were practically severed, and the structures of the thenar eminence were partly pulped although the overlying skin was intact. It was decided to remove the thumb at the metacarpophalangeal joint, and to excise the heads of the two adjacent metacarpals. I felt all the time that it was foolish not to do a clean amputation at the wrist.

In the event, however, the conservative operation was justified: after four days' pyrexia, during which œdema spread nearly to the forearm, the condition settled down, and secondary suture was performed on the eleventh day.

In addition to the cases detailed above, the usual routine cases were dealt with. These included fractures of the radius and femur, tonsillectomies, a tertiary syphilitic from a neighbouring village with gummata on the face and sternum, varicose veins (treated, with rather an alarming reaction, by quinine and urethane), and a fish-bone in the throat which completely defeated me.

Travel.

A MONTH'S TRIP UP THE SUTLEJ VALLEY FROM SIMLA, JUNE, 1934.

BY MAJOR R. W. CARDEW, M.C.,
Royal Engineers.

THIS trek was the result of a hasty trip on six days' leave at Easter out to Narkanda, some forty miles from Simla on the Hindustan-Tibet road. The view of the snows from Narkanda is magnificent, but the urge to get nearer sent me examining maps and making out a trip for a month, knowing that this was all the leave I could get or could conveniently afford.

Thus, the trip was mapped out to see as much as possible in the short time, including a visit to one glacier at least.

On studying the map, I found the nearest way to get at a glacier was to break off the Hindustan-Tibet road about 100 miles out and go up a valley into the blue—a dotted line showed a path across high ground up to the foot of the Zangsu Glacier; and with this object in view I set out.

The plan was to go by the upper road, as it was June. This road takes off at Narkanda and joins the main or valley road at Sarahan, about 90 miles out. The upper road is 20 miles longer, but well worth it—for prettiness and coolness.

My party consisted of two mules with a mule man, a bearer and a hill man as mate and odd jobs man.

The mules I bargained for, and got them for Rs.4/- a day the pair. If one takes mules by stages, it is far more expensive; and as I knew I had to return more or less the same way, there would be no need to dispense with them for other means of transport, except on the 20 miles off the main road up to the glacier.

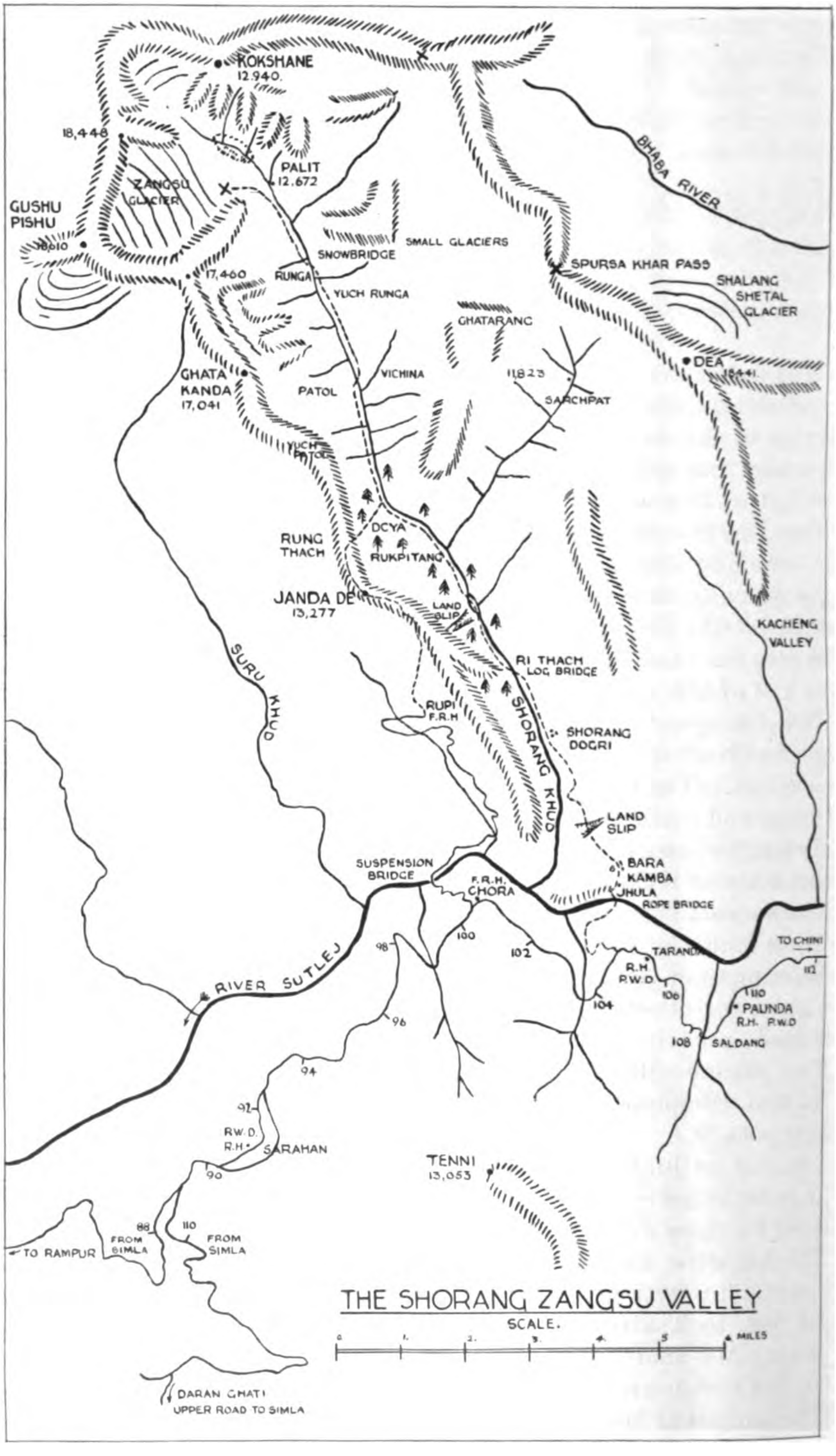
Two yakdans filled with eatables, bedding, a suitcase, a 40 lb. and a 20 lb. tent, completed the outfit, plus the servants' gear and a few odd cooking pots.

I started on June 3.

In order to get over the portion to Narkanda, which I knew, we double-marched for three days—as far as a forest bungalow at Kadrala—56 miles.

The following day was a short march of 10 miles, so I was able to reconnoitre my next day's walk in which I was going over Maral Kanda, 12,244 feet, to Taklech, while the transport went by the main road—22 miles. My route was about 14 miles, but up from 8,000 feet to 12,000 feet and down again to 5,500 feet at Taklech.

The summit of Maral Kanda is studded with curious piles of flat ston e


KOKSHANE
12.940.
18,448
PALIT
12.672
ZANGSU
GLACIER
GUSHU
PISHU
18,010
17,460
RUNGA
SNOWBRIDGE
SMALL GLACIERS
YUCH RUNGA
SPURSA KHAR PASS
SHALANG
SHETAL
GLACIER
BHABA RIVER
GHATARANG
DEA
GHATA
KANDA
17,041
PATOL
VICHINA
11,823
SARCHPAT
YUCH
PATOL
DCYA
RUNG
THACH
RUKPITANG
JANDA DE
13,277
LAND
SLIP
SURU KHUD
RI THACH
LOG BRIDGE
RUPI
F.R.H
SHORANG KHUD
SHORANG
DOGRI
KACHENG
VALLEY
LAND
SLIP
BARA
KAMBA
JHULA
ROPE BRIDGE
SUSPENSION
BRIDGE
F.R.H.
CHORA
TO CHINI
TARANDA
R.H
P.W.D
100
102
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106
108
110
112
PAUNDA
R.H. P.W.D
SALDANG
98
96
94
92
RIVER SUTLEJ
P.W.D.
R.H.
SARAHAN
90
TENNI
13,053
88
110
FROM
SIMLA
FROM
SIMLA
TO RAMPUR
DARAN GHATI
UPPER ROAD TO SIMLA
THE SHORANG ZANGSU VALLEY
SCALE.
MILES

erected presumably as votive offerings by people of olden times, as the present local inhabitants could tell me nothing of their purport. A very well-made track up the mountain also exists with steps made from flat stones, so that evidently at some past date pilgrims have used this road. The drop down from Maral Kanda was through lovely woods, and I reached Taklech an hour before the mules.

A day's rest for the mules enabled me to make up towards the mountains named Hansbeshan, 17,000 feet, but before 10 a.m. they were clouded over, so that it was useless to continue up the mountain side. Instead, I spent a pleasant hour in the valley bathing in a stream.

The following day was a 12-mile uphill march to the Forest Rest House, at Daran Ghati.

A glorious view, however, makes up for the hot march, and I stayed a day in order to see Hansbeshan if the clouds were kind. They, however, came up just after dawn and did not quit till dusk.

One more march brought us to Sarahan, the summer capital of the Rajah of Bassahr State, whose winter home is at Rampur, on the Sutlej, at only 3,000 feet altitude.

At Sarahan, I got my "dak" (mail) and was able to send off letters, there being no post office between Bagi (10 miles from Narkanda) and Sarahan.

Next morning we reached Chora, 10 miles further on, where I was to quit the main road. After lunch, I walked on some miles investigating the valley on the opposite of the Sutlej with a telescope in order to be able to recognize peaks and knobs of hills, when I got over there. It was not possible to take the mules across the Sutlej to Rupi, as report had it that the bridge floor was broken. This I was able to check from above through my telescope, as I could see a shadowless gap on the water under the bridge where evidently there was no bridge flooring. I had just thought it was due to laziness on the part of the bearer and mule man, who did not seem to want to move off the level road.

The following morning early, I, my hill man Salli, and two coolies set forth down the "short cut" to the bridge some 1,500 feet below, and then up the other side of the valley to Rupi. There I camped, and met the Forest Ranger of the Pandra Bis ranges, who made arrangements for three local men to accompany me up to the Glacier Valley, the two men I brought from Chora returning there. The mule drivers had also been instructed to proceed one march to Taranda and await my arrival, when, I could not say exactly, but in four or five days' time.

We were off at dawn and set our faces up the mountain side making for a knob called Janda De to commence with.

However, after reaching the limit of the forest at about 11,000 feet at 11 a.m., and after a short halt for lunch, it took up till 5 p.m. to reach Janda De, owing to the so-called path merely being along the rocky crest of a spur and up and down 200 feet at frequent intervals. My objective

on the map being a similar further distance beyond Janda De, I decided it was quite impracticable, and picked the only flat portion of mother earth, the summit of Janda De, 13,277 feet, as camp. The men sheltered comfortably under some large rocks within a few feet of the tent.

It was a glorious evening till 7 p.m., when clouds gathered ominously. However, the storm which eventually broke at 4 a.m. was short lived, and dawn brought a wonderful cloud-flecked sky, with snow mountains all round—Gushu Pishu, Ghata Kanda, Kokshane, Ghatarang and Dea close by, Kailas and Raldang in the east some 20 miles away and the back of the Hansbeshan peaks across the valley to the southward.

Fig. 1.—Camp on Janda De, 13,277 feet. Ghata Kanda, 17,000 feet in centre; Kokshane, 18,940 feet in right background; Gushu Pishu, 18,610 feet, in left background.

A little discussion with the elderly hill man who acted as guide brought the decision to descend into the Zangsu (or Shorang) Valley, rather than carry on along the ridge, though since then I regret not doing the latter. The descent was a scramble over snow slides, down rocks, over grassy slopes at a slippery angle for about three hours, till we reached water.

The previous evening the only water was melted snow.

Then into virgin forest, with rhododendron bent parallel to the ground during the winter by snow. This was the worst part, and one's clothes suffered considerably. Periodically a halt was necessary to circumvent a "dankar" or precipice which appeared below the next tree. However, we reached the torrent at 9,000 feet altitude about 3 p.m., and camped under the "boot," which I gathered was the local name for a large tree.

It was certainly warmer than the top of Janda De for camp.

Leaving my own hill man and two coolies at camp, at dawn again I set out with the old man, and the two of us proceeded up the valley to the glacier, about 6 miles by the map.

There certainly was a path of sorts, vanishing under mud slides here and there.

By 10.30 we had gone some 5 miles and were nearing my objective—the glacier which up to the last was tucked behind and hidden by a rocky spur.

FIG. 2.—Looking up the Zangsu Khud Valley; Mount Kokshane. 18,940 feet, in background. Zangsu Glacier is behind spur to the left.

The view of Kokshane (18,940 feet) ahead of us all the time was wonderful, with the sun glinting on the ice-clad pinnacles and snow slopes.

En route, I came to dwellings marked on the map by red dots which indicated houses but never a house—my old shepherd informing me that the large cavities under certain rocks were the places named on the map—shelters for the shepherds who bring their flocks along the same route as I had come, and stay from July to September under these awe-inspiring peaks and crags.

My guide seemed weary and anxious I should go no further, but I said I wanted to see the glacier. This he could not understand—who wanted to see cold ice? So I told him to remain and I would see the glacier: so off again up an old moraine, across snow beds, over rocks and at last round the spur—what a sight! The whole glacier glistening in the sun, with a rocky crag and a peak at the far side, 18,448 feet. From the point I reached, which was about 14,000 feet by the aneroid approximating to the map height given at a rock in the valley head, the peaks towered above

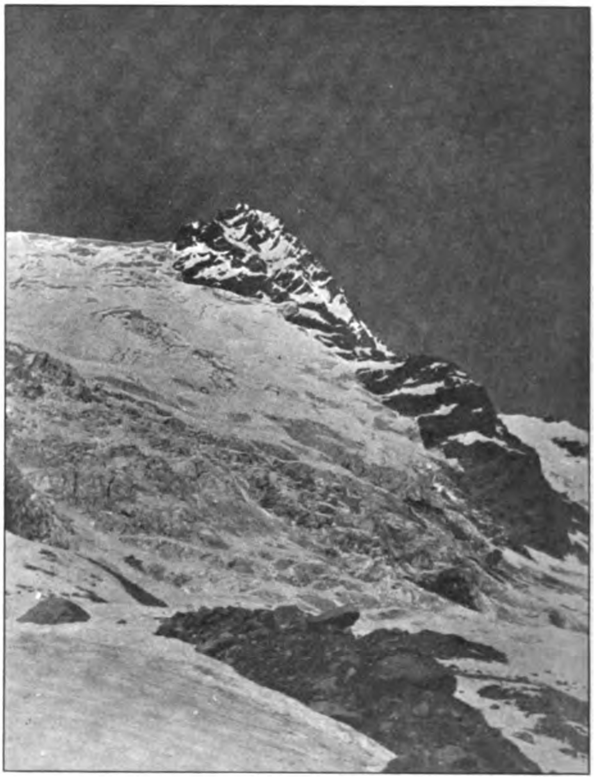

Fig. 3.—The Zangsu Glacier. Peak 18,448 feet. Taken from about 14,000 feet.

one—such a valley head—glacier to the left, then a peak, then a dip on the other side from which I knew the Pin and Parbati rivers rise, and thence round to the Kokshane on the right.

Alone I could go no farther for fear of getting into difficulties, and the guide about a mile behind out of sight, so the only thing was to sit down and eat my lunch and feast my eyes on the grand scene and take photographs. I had not much time to spend there, only an hour or so, as there were six miles to get back.

Return to camp was uneventful.

An early start next morning was necessary, as I was anxious to get back to Taranda in one day. The track down led across a spot which had once been formed into a lake by the hillside, some 2,000 feet high, sliding down and blocking the valley. The water filled up and then ran over the edge, cutting a narrow gulley into a series of cascades but leaving no lake—only a levelled patch a mile long, across which the stream now goes in several shallow branches. These had to be waded and were ice-cold, of course.

After this the track leads over to Rupi; but I wanted to make the opposite bank, so a scramble was necessary, and then a gap to cross on a fallen tree. The existing one was rotten, so we had to set to and procure

Fig. 4.—The Buran Pass about 15,000 feet between the Baspar and Patar River Valleys.

other trees and make a bridge 25 feet span between two rocks, with the torrent 40 feet below in a chasm.

I crossed nervously I must say, but it had to be done—a rope held each side and tied round me improved my nerve in case of a slip. Shoes were, of course, discarded, and the log crossed in my stockinged feet.

Thence the path improved and we reached Bara Kamba about 1 p.m.

Here I paid off my Rupi men and sent them home, and procured two other men to descend to the Sutlej and take my kit up to Taranda.

The descent was perilously steep, and 2,000 feet sheer down in a cleft in the rock—the main road to Taranda village.

Again stockinged feet for most of the descent, with one hill man in places holding his hand so that my foot did not slip off the hollows cut into the rock as steps.

At the bottom was a jhula or rope bridge of the kind common up these parts—a wire rope stretched across the river, and a traveller from which hangs a board by four chains, on which one sits.

On the words "go," the traveller runs to the centre down the rope and is then hauled up by the man on the far side. It takes a few minutes for the man to take in the slack of the hauling rope, a country-made grass rope at that, apt to break at any time and leave one suspended in mid stream till it can be repaired. We were lucky, and no rope broke.

FIG. 5.—Clouds over the Sutlej Valley from near Wangtu.

Two thousand feet to climb the cther side up a good path however, and not quite so steep as the descent on the Bara Kamba side; and so to Taranda by 6 p.m. after 14 miles of strenuous going.

Here my excitement ended, and the remainder of the journey was on the main road again.

I had just time for two more marches further up the Sutlej, and made for Kilba at the junction of the Sutlej and Baspar rivers.

The first night we spent at Wangtu, which is hot and dusty. We passed Nichar, a beauty spot, and resolved to return there to camp on the return journey, instead of Wangtu.

I had one full day at Kilba, spending two nights and doing a 10 mile walk from Kilba up on to the hill above the Baspar river, from which there are grand views of Kailas and Raldang peaks, up the Baspar river and across to the Buran or Borenda Pass, which is over the Hansbeshan ridge.

At Kanahi, the village on the hill side, I came across a Buddhist shrine, a "mane" wall and a chorten. The interior decoration of the gateway was beautifully painted with pictures of dragons and demons.

And from here I had to return, as my days of leave were numbered and I had but one spare day in hand in case of accidents on the return journey.

At Sarahan, we took the valley road to Rampur, 20 miles, which was extremely hot and unpleasant, but we struck rain for the first time since leaving Narkanda and that cooled things a little.

From Rampur, I made Luhri in one day, about 22 miles, and from Luhri climbed to Narkanda: a hot climb for the first six miles. At Narkanda we met the rains proper, and for the three days in from Narkanda to Simla it rained consistently.

On the road we passed a gathering of men from Kulu who were taking four Devtas or symbolic idols on the way from Kulu to Patiala's hill capital at Chail, for a festival—a distance of 400 miles. At each stopping place a ceremony occurred, and the incessant noise of drums and trumpets broke the silence of the mountains throughout the day and night.

On totalling up the mileage, including odd walks after the day's march and walks on the days the mules rested, I found I had walked about 370 miles, which I had done in 27 days from start to finish and without fatigue.

The approximate distances are as follows :—

	Miles
Simla to Theog	17
Theog to Narkanda	23
Narkanda to Kadrala	17
Kadrala to Sungri	11
Sungri to Taklech (over Maral Kanda)	14
,, ,, (by the road)	21
Taklech to Daran Ghati	12
Daran Ghati to Sarahan	18
Sarahan to Chora	11
Chora up to the Zangsu and back to Taranda (five days)	40
Taranda to Wangtu	13
Wangtu to Kilba	11
Kilba to Nichar	14
Nichar to Taranda	10
Taranda to Sarahan	14
Sarahan to Rampur	20
Rampur to Luhri	22
Luhri to Narkanda	13
Narkanda to Matiana	11
Matiana to Fagu	17
Fagu to Simla	12

A note of warning to those who may do a similar trip: stores and food are almost unobtainable, except a few chickens here and there. Eggs

seemed almost unknown. Atta of a kind can be got, and the servants managed to supply their wants.

Cigarettes are scarce except in the large places such as Saraban and Rampur, and at one small out of the way shop kept by an Ambala family at Saldang, not far from Taranda.

I regretted not being able to get into Buddhist country beyond Chini, but another week or ten days would have been necessary to reach the Tibet border at Shipki. That must remain for another time.

Current Literature.

WÜHRER, J. Zur gesundheitlichen Beurteilung des Aluminiums, insbesondere im Aluminiums-Ess-Trink- und Kochgeschirr. [**The Harmlessness of Aluminium especially with Regard to its Use for Eating, Drinking and Cooking Utensils.**] *Arch. f. Hyg. u. Bakt.* 1934, v. 112, 198-216. [Refs. in footnotes.]

Aluminium combined with silicic acid is very widely distributed and forms 7 to 8 per cent of the earth's crust. It is found normally in minute quantities in plants, animals and the human body. A number of investigations by various workers extending over many years are quoted to show that the use of aluminium cooking vessels is not injurious to health. It is, however, agreed that aluminium containers are not suitable for keeping foodstuffs containing acid fruit juice. Thus 400 grammes of apple were cooked in 250 cubic centimetres of water in an aluminium vessel for three-quarters of an hour and allowed to stand in it for two days, after which 20·8 milligrammes were found in the content. On the other hand 400 cubic centimetres of potato starch paste were cooked for a quarter of an hour in a similar vessel and left to stand in it for three days when the quantity of aluminium in the content was found to be only 0·7 milligramme.

Feeding experiments on animals have shown that aluminium salts only pass through the mucous membrane of the alimentary canal to a very slight extent, and that practically all the aluminium given by the mouth is recovered in the fæces. When animals are given acid-reacting aluminium salts with their food in high concentration they lose their appetites and show considerable loss of weight, but such a high concentration of acid aluminium salts is out of the question under the conditions in which human food is prepared.

Aluminium combined with silicic acid occurs in the clay used for making earthenware vessels and no injurious effects to health have been attributed to their use.

No diminution in the vitamin content of food cooked or preserved in aluminium vessels has been found. A. J. COLLIS.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 11.

BERTRAND, G., AND SERBESCU, P. L'ingestion journalière de petites quantités d'aluminium favorise-t-elle le cancer? [**Does Daily Ingestion of Aluminium encourage Cancer?**] *Ann. Inst. Pasteur.* 1934, v. 53, 10-22.

The authors used rabbits in two groups. One group received tar treatment known to induce cancer but no aluminium, the second group the same treatment, but also daily doses of aluminium sulphate introduced directly into the stomach. The total dose was 20 milligrammes of aluminium per kilo weight.

Of 48 rabbits in the first group, considering only those which survived for over forty days, the percentage suffering from tar cancer was 78·3. Of 68 rabbits also receiving aluminium, and considering survivors over forty days, the percentage suffering from tar cancer was 50. There was no difference in the lesions of the two groups. Rabbits can support without harm very considerable doses of aluminium. The author considers that the harmfulness of aluminium has been very greatly exaggerated and that there is no evidence in favour of the suggestion that its continued ingestion causes cancer. W. G. SAVAGE.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 11.

FAIRLEY, A., LINTON, E. C., and WILD, F. E. **The Toxicity to Animals of 1 : 4 Dioxan.** *The Journal of Hygiene.* 1935, v. 34, No. 4, pp. 486-501.

1 : 4 Dioxan, a glycol derivative, is used in industry as a solvent of fats and resins. Its toxic properties were reported on by the United States Public Health Authorities in 1930, when it was concluded that the results of prolonged exposure to the vapour were œdema of the lungs and hyperæmia of the brain preceded by irritation of the eyes and nose, severe enough to alarm and warn those who were exposed to its effects.

In their present paper the workers at Porton describe further investigations, the outstanding results of which have been the severe lesions found in the kidneys and livers of the animals employed, such lesions following on inhalation, intravenous injection, oral administration or by application to the skin.

The respiratory tract was only found to be affected when high concentrations were inhaled, and human observers subjected to short exposures of nominal concentrations of as much as 1 : 500 found none of the lachrymatory or other signs of irritation previously stated to occur.

SÜPFLE, K. Zur Frage der chronischen Kohlenoxydvergiftung. [**Chronic Poisoning by Carbon Monoxide.**] *Deut. med. Woch.* 1934, v. 60, 1263-7.

For several years the author and his co-workers have carried out a number of experiments on dogs to determine the effect of the inhalation of

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small quantities of CO for several hours a day for about four months. Dogs were found more suitable than rabbits, guinea-pigs or mice. They were kept in large glass chambers for six hours a day (three hours only on Saturdays and not on Sundays) and fresh air containing definite proportions of CO was introduced by a small electric fan on one side of the chamber and allowed to escape by an outlet on the other. Five hundred litres of the air mixture was introduced for each animal per hour, and great care was taken by periodical analyses to insure that the desired strength of CO was maintained in the chamber. When the dogs were not in the chambers they were free in a large garden. The inhalation of low strengths of CO, viz. 50 to 100 volumes of CO per million volumes of air (vol. mill.), caused no apparent ill-effects after fifteen weeks, and the dogs remained in perfect condition and all put on weight. With a strength of 200 vol. mill. the animals became restless and irritable, and the pitch of their bark was raised.

A dog which had not been used for previous CO experiments was given a strength of 600 vol. mill., and after about five hours lay panting and apathetic on the floor of the chamber and vomited frequently. Next day it was not put in the chamber and recovered: on the following day, when it was put in the chamber and given the same strength of CO, it was found there was not so much disturbance, and after two weeks of inhaling this strength there was no disturbance at all, so that the animal was as fresh and lively after six hours as when it was put into the chamber. This was confirmed with two other dogs and shows clearly that they became accustomed to large doses.

In all the dogs the leucocyte count during the first week showed a small but definite increase which lessened after a few weeks. However, with the strength of 600 vol. mill. the increase continued till the end of the experiment. There was an increase in the number of red blood-corpuscles and also in the quantity of hæmoglobin, even with such a low strength as 50 vol. mill., when there was an average increase of 15 per cent of hæmoglobin. It was found that the greater the strength of CO the greater the increase in the number of red blood-corpuscles. There is a similarity in this respect with the changes which occur in the blood of men who climb high mountains where there is a deficiency of O, and these changes may be regarded as compensatory.

In Dresden the illuminating gas contains an average of 15·8 per cent CO. When this was mixed with air so as to give a CO content of about 50 vol. mill. the smell of the illuminating gas could not be detected, but could be distinctly when the content of CO was 150 vol. mill. There is some danger of chronic CO poisoning in the use of gas cookers, from the unavoidable escape of gas which occurs after turning on the tap and lighting the gas. A. J. Collis.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 12.

NAMMACK, C. H. and BITTMAN, FLORENCE, R. **A Typhoid-like Infection Associated with an Organism Resembling** *Bacillus proteus pseudo-valeriæ* **(de Assis).** *Journ. Lab. and Clin. Med.* 1934, v. 19, 1094-7.

An illness which commenced shortly after the partaking of a beef sandwich is described. The patient, an adult male, was seized with abdominal discomfort and fever, which were followed by prostration, jaundice and a typhoid-like state, slow recovery taking place after three months. An organism which was isolated from the blood in the third and fourth weeks, and from the fæces late in the disease, was agglutinated by the patient's serum, tested in the fifth week, to a titre of 1 : 2,500. The patient's serum did not agglutinate *Bact. typhosum*, *Bact. paratyphosum* A nor *Bact. paratyphosum* B.

The organism was a Gram-negative, motile rod of varying length, giving a *Proteus*-like growth on solid media and producing acid and gas in a wide range of sugars, including glucose, maltose, mannite, sucrose and salicin, but giving a feeble acidity only in lactose after seven days. A large dose (0·5 and 0·75 cubic centimetre of an eighteen-hour broth culture) proved fatal to two guinea-pigs when injected intraperitoneally. The organism was not agglutinated by *Bact. typhosum*, *Bact. paratyphosum* A nor *Bact. paratyphosum* B antisera.

Having discussed the differences between this organism and similar ones described by Boycott, by Castellani and by Hauser, the authors conclude that it most resembles *Bacillus proteus pseudovaleriæ* recovered by de Assis from the blood of a patient suffering from an illness of the same nature, which was also followed by recovery. J. C. CRUICKSHANK.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 12.

JUDE, L. V. R. Les affections typhoïdiques dans l'armée avant et après la vaccination préventive. Aperçu rapide sur la situation de la XVe région à ce point de vue. **[Enteric Fever in the French Army Prior and Subsequent to Preventive Inoculation.]** *Arch. Méd. Gén. et Colon.*, 1934, v. 3, 269-79, 4 charts.

The author first gives information respecting the incidence of enteric fever in the French army before the Great War. From 1888 to 1911, the mean morbidity rates per 1,000 effectives varied from more than eleven in the Fifteenth Army Corps to two in the Second Army Corps. At the beginning of the Great War it reached a figure of nearly twelve; then, as prophylactic inoculation was applied more seriously, declined sharply, and during 1917 and 1918 was very low. After the War vaccination was steadily employed with certain modifications of the technique (detailed by the author). In 1923 the morbidity-rate was 0·22 per 1,000. In the Fifteenth Army Corps (stationed in the south of France), the morbidity of which was so high in the pre-war period, the rate has not exceeded 1 per 1,000 since 1926, and in 1932 was 0·468. M. GREENWOOD.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 12.

GALLARDO, E. Sur la production du virus vaccinal et la technique de la vaccination. [**On the Production of Vaccine Virus and the Technique of Vaccination.**] *Bull. Office Internat. d'Hyg. Pub.*, 1934, v. 26, 1233-6.

Dr. E. Gallardo, Head of the Vaccine Institute of the National Hygiene Institute of Madrid, gives his personal views on the best methods of lymph production and vaccination technique. The standard method of calf lymph preparation is condemned on account of the impossibility of entirely eliminating adventitious bacteria, in spite of numerous trials of various germicides. Kaolin adsorption and filtration are recognized as a marked advance, but are impracticable for general use. A high degree of purity is obtained in neurovaccine, but, owing to its high potency and neurotropic character, this has not come into general use except in Spain, where over eight million vaccinations have been performed with it. Dermovaccine cultivated on chick embryo medium is regarded as far in advance of any other vaccine, and desiccation in cold vacuum is regarded as the method of election for storage. As regards vaccination technique, the ordinary cutaneous method was justified so long as there was no bacteria-free vaccine, but now that this seems likely to be freely available the author regards subcutaneous vaccination as the method of the future. The technique of the intracutaneous method is too difficult for general use. O. K. WRIGHT.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 12.

GOODPASTURE, E. W., and BUDDINGH, G. J. Immunisation de l'homme par un vaccin dermique, cultivé sur les membranes de l'embryon de poulet. [**Human Immunization with a Dermal Vaccine Cultivated on the Membranes of a Chick Embryo.**] *Bull. Office Internat. d'Hyg. Pub.*, 1934, v. 26, 1226-32.

This describes work already published elsewhere (this *Bulletin*, 1934, v. 9, 386). In addition it describes the use of the culture vaccine for vaccinating school children. Out of 980 primary vaccinations in subjects aged from 5 to 20, 92·9 per cent were successful. It is pointed out that the criterion of primary vaccination was the absence of visible evidence of previous vaccination or smallpox, and that the percentage of successes was appreciably higher in white children than in coloured. As undetected prior smallpox is much more probable among the latter, it is suggested that a proportion of the failures were due to this cause. From these studies it is concluded that it is possible to prepare by culture on chick embryo a vaccine of satisfactory activity, with good keeping qualities, free from bacteria and suitable for use for human vaccination in the ordinary conditions of practice. O. K. WRIGHT.

Reprinted from "Bulletin of Hygiene," Vol. 9, *No.* 12.

Reviews.

SOME NOTABLE EPIDEMICS. By H. Harold Scott, M.D., F.R.C.P., D.P.H. London: Edward Arnold and Co. 1934. Pp. xix + 272. Price 12s. 6d. net.

This interesting book is an effort to produce in a convenient form a historical record of certain British epidemics which have, for various reasons, assumed such special importance to the student of epidemiology as to merit the description of "classical."

Beginning with the "Broad St. Pump" epidemic of cholera of 1854 over twenty outbreaks of epidemic disease are studied from the information on record and also, in the case of the earlier ones, from the point of view of our modern knowledge of the causative agents and the means by which these are spread. The book closes with a description of the outbreak at St. Pancras in 1933 of Sonne dysentery due to the accidental infection of pease pudding with *B. dysenteriæ* Sonne.

It is noteworthy that the author has confined his studies to epidemics spread by means of water and various articles of food and has omitted mention of outbreaks of diseases spread by other agencies; outbreaks of which there have been many of interest to the student in the period covered both on historical and purely epidemiological grounds. For this reason the treatment of the subject is rather one-sided, but it must be admitted that, within well-defined limits of time, place, and the nature of the diseases considered, Dr. Scott has made a wise selection of epidemics which illustrate clearly the methods of investigation and prevention both in the pre-bacterial period and since the help of competent bacteriologists became available. He has also done a great service to students by collecting this information from scattered reports and publications and by publishing it in a form in which it can be so easily read.

The book is most likely to be of value for students undergoing training for a Diploma in Public Health.

STORIES FROM WORLD HISTORY: TALES OF THE ANCIENT GREEKS AND PERSIANS; THE STORY OF THE SIEGE OF TROY; THE ADVENTURES OF ODYSSEUS; TALES OF THE ROMANS. Retold by Enid Blyton. London: Evans Brothers Ltd. Pp. 64 each. In Manilla covers 8d. net., limp cloth 10d. net.

This series of small books contains in simple English the parts of those classical studies which in our youth we found most interesting although not always easy to follow on account of our somewhat hazy knowledge of the tongues from which our preceptors wanted us to translate.

In these volumes the modern child can find the tales of Greece and Rome retold in a form that is entertaining, instructive and very easy to read.

THE CHANCES OF MORBID INHERITANCE. By Various Authors. Edited by C. P. Blacker, M.A., M.D. London : H. K. Lewis and Co., Ltd. Pp. xii + 450. Price 15s. net.

The question of the inheritance of mental or physical diseases is a very important one and as it has recently received a certain amount of public attention the medical practitioner may expect to be asked from time to time to furnish an estimate of the probability of a given disease being inherited. The problems that are likely to confront him are ably discussed in the present volume by specialists in those diseases in the causation of which heredity and environment are important factors. If the instructions given in the appendix are carefully followed, the task of preparing a family pedigree becomes a comparatively simple one.

The book as a whole is clearly written and should prove a valuable guide to the general practitioner in arriving at a eugenic prognosis.

GARROD, BATTEN and THURSFIELD'S DISEASES OF CHILDREN. Third Edition with contributions by 36 Authors. Edited by Hugh Thursfield, D.M., M.A., F.R.C.P., and Donald Paterson, M.D., F.R.C.P. London: Edward Arnold and Co. 1934. Pp. xii + 1152. 277 illustrations. Price 50s. net.

This new edition is probably the best textbook yet printed in English on Diseases of Children.

It is difficult to imagine anything better than the chapters on "The Feeding of Infants and Children," "The Newly Born Baby" and "Functional Diseases of the Nervous System."

The Sections on "Hare-lip and Cleft Palate" and "Disturbances in Great Part due to Mismanagement" should be read by everyone who advises on the care and treatment of children. The importance and frequency of pyelitis in children is stressed, and rightly so as this condition is frequently overlooked in young children.

All the common and most of the rare conditions of diseases of children are adequately described, and appropriate treatment is indicated.

As in all textbooks by many authors in collaboration there is a lack of balance. The 20 pages on immunity could well be reduced, and the 32 pages on rickets and tetany lack the interest provided by the rest of this excellent book.

The illustrations are good and apt. C. A. W.

SYNOPSIS OF SURGICAL ANATOMY. By Alexander Lee McGregor, M.Ch.Edin., F.R.C.S.Eng. Second Edition. 1934. Bristol: John Wright and Sons, Ltd. Pp. xix + 644. Price 17s. 6d.

In the preface to this edition the author states that the size of the book has been reluctantly increased by a few pages, due to incorporation of small sections rendered necessary by advancing knowledge. The section on amputations has been rewritten and a most useful section on palmar

incisions has been included. In reviewing the first edition, the writer strongly recommended this handy, plentifully illustrated (in a clear semi-diagrammatic manner), and fascinating little book. He has recommended it to many students—especially those sitting for advanced degrees—and it has always been received with whole hearted enthusiasm. To all officers in the Royal Army Medical Corps this recommendation is again repeated, and more especially to radiologists and surgeons. A tendency still persists to deal with infections of the hand by inadequate, and often misplaced, "painful nicks" in a Medical Inspection Room. The section on "palmar incisions" alone should make this book worthy of study, if it assists in eradicating this tendency.

The publishers are to be congratulated on their production.

D. C. M.

Correspondence.

CONVERSION OF LORRIES INTO MOTOR AMBULANCE CARS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The objections to the conversion of lorries into motor ambulance cars have been expressed succinctly and completely in Colonel F. S. L. Ford's letter in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS of January, 1935.

When war broke out in 1914, the use of R.A.S.C. motor lorries for the conveyance of wounded was officially recognized. During the battle of the Aisne in September-October, 1914, I was O.C. No. 4 Clearing Hospital at Braisne, close to the Aisne, and witnessed the arrival of convoys of wounded who had been brought in by motor lorries. This method involved great suffering to many of the wounded, and, as I ascertained from the R.A.S.C. officer in charge, extreme inconvenience to the R.A.S.C. It meant that the R.A.S.C. personnel had to work without reasonable time for rest and meals, to say nothing of the diversion of the vehicles from their proper function. I may add that this method of transport of wounded had been used by the Germans in South-West Africa a few years before the Great War, and was condemned in the official medical history of that campaign. If the method was bad for the wounded in a war in which the enemy had no artillery, how much worse in the case of war in which wounds from shell fire were numerous.

I hope no such retrograde proposal will meet with support from the Medical Service.

10 *Mennage Road,*
Penzance.
January 16, 1935.

I am, &c.,
J. G. MCNAUGHT,
Lt.-Col., R.A.M.C. (rtd.)

Notice.

THE EIGHTH INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND HYGIENE.

The Eighth International Congress of Military Medicine and Hygiene is to be held this year from June 27 to July 3 at Brussels (not, as formerly arranged, at Bucharest), where there will also be an Exhibition.

Various discussions are to take place among which are the following:—

"Principles of organization and of the working of the medical services in mountain warfare" (Italy and Roumania).

"Sequelæ of abdominal wounds" (Roumania and United States of America).

"The unification of the various methods of analysing food and drink intended for the use of the soldier."

"A comparative study of the administrative duties and functions of the medical services of the Navy, Army and Air Force."

The Congress is open to all medical officers of the Regular Army, Territorial Army and Reserve of Officers, and it is hoped that many will take this opportunity of attending the Congress.

Any further information can be obtained from the Secretary, Office de Documentation des Congrès de Medicine Militaire, Liége, Belgium, or by pre-stamped envelope to Colonel W. Benson, D.S.O., Headquarters, London District, Horse Guards, Whitehall, S.W.1.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

A free issue of twenty-five reprints will be made to contributors of Original Communications and of twenty-five excerpts in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, Journal of the Royal Army Medical Corps, War Office, Whitehall, London, S.W. 1."

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Each subscriber who pays his subscription direct to the Manager will also receive monthly a copy of "The R.A.M.C., The A.D. Corps, and Q.A.I.M.N.S. *News and Gazette*."

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Journal
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Royal Army Medical Corps.

Original Communications.

ON MANŒUVRES WITH A MECHANIZED FORCE.

BY COLONEL P. J. HANAFIN, D.S.O.

ON a recent Southern Command Exercise I was detailed as Assistant Director of Medical Services of a Mobile Force. This force consisted of: 11th Hussars, less one squadron, (an armoured car regiment); 1st Tank Brigade; 7th Infantry Brigade—three battalions with mechanized transport and embussed infantry. These formations had attached to them a very large proportion of ordnance units, supply units, etc., so that the wagon column consisted of 1,004 vehicles. It assembled at Highnam, west of Gloucester, on September 17, 1934.

The special idea of the manœuvres was briefly as follows :—

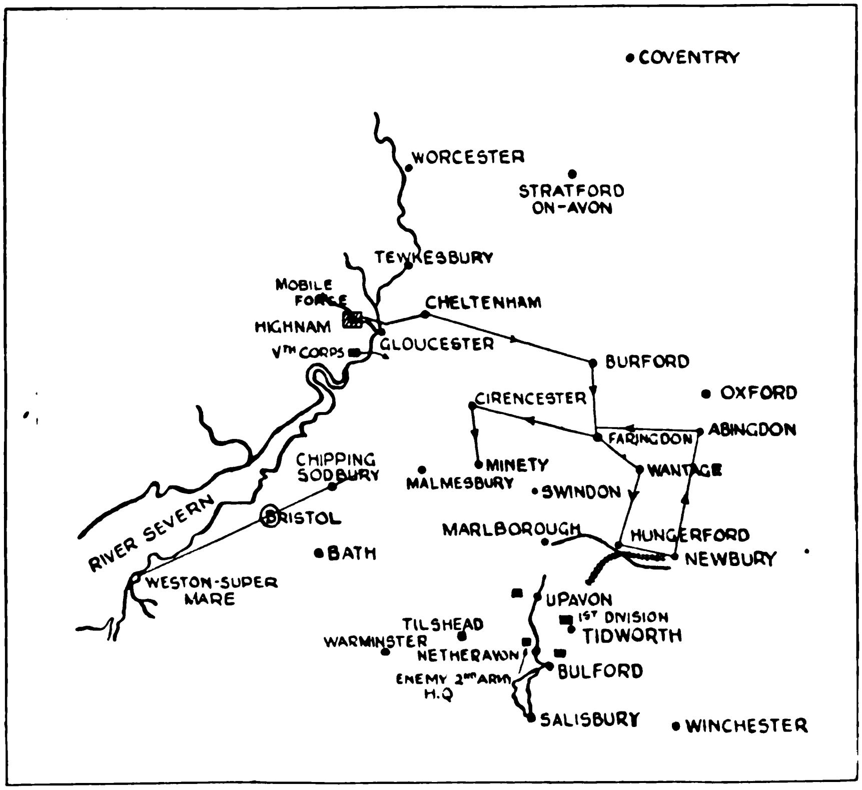
Eastland and Westland were at war. The frontier running between them was: The Severn to Saul, Cheltenham, Stratford-on-Avon, Coventry. Westland has invaded Eastland and its armies occupy the line : Weston-super-Mare, Bristol, Chipping Sodbury, with Eastland's main position about seven miles south-east of this. Westland's V Corps was crossing the mouth of the Severn and would be east of it by evening of the 17th. The Commander-in-Chief proposed to attack the Eastland army on September 21 and turn its right flank.

On Salisbury Plain were a large number of Eastland aerodromes, munition dumps, etc., in addition to the Second Army Headquarters. The only fighting formations for the defence of this important area were the First Division and one squadron armoured cars in the neighbourhood of Tidworth, Bulford, Netheravon.

The General Officer Commanding Mobile Force was ordered by the

Westland Commander-in-Chief to raid this area, crossing the frontier not earlier than 02.00 hours on the 19th, doing as much damage as possible to important enemy centres and returning to Minety by 15.00 hours on the 21st and to be prepared in time to exploit the success which was expected when Westland attacked the enemy's armies on the 21st. He thus had sixty-one hours to carry out the raid.

The medical problem presented was entirely novel and the following appreciation was written sitting in a car at Highnam on the afternoon of



September 17. It was written very hurriedly and under what might be considered to be active service conditions and may be of interest for that reason if for no other.

The appreciation assumed that medical units in accordance with present war establishments had been provided. Actually two small units, of 2 medical officers, 5 other ranks and 2 motor ambulances each, accompanied the force, so that the appreciation was only of academic interest and was not presented to the General Officer Commanding. Arrangements had, however, been made that the O.C.'s of these units were to assume that the medical units mentioned in Appendices "A" and "B" were mobilized by the night of the 19th/20th and were to consider during the course of the

manœuvres how these units could deal with the various situations that arose. The assumption as to tactical situations and casualties mentioned in the appreciation have been reviewed by the General Officer Commanding the force and approved by him.

APPRECIATION OF THE SITUATION BY THE A.D.M.S. MOBILE FORCE.

Highnam, September 17, 1934.

(1) *Object of the Appreciation.*

To consider the best means of preservation of the health of the force and the treatment and evacuation of sick and wounded with the means at our disposal.

(2) *Factors Influencing Attainment of Object.*

(*a*) *Preservation of Health.*—The campaign is being conducted at a healthy time of the year and no serious epidemics are anticipated. The usual colds, injuries, etc., will probably give us a daily sick rate of 0·3 per cent. daily, of which 35 per cent. will be stretcher cases. Two blankets per man will be required at present, and in three weeks' time three per man.

(*b*) *Evacuation of Wounded and Sick.*—The means at my disposal for this purpose are totally unsuitable, and should be modified as indicated at once.

A field ambulance (7th) has been provided for use with the 7th Infantry Brigade. This includes sixteen horsed vehicles which must be changed for motor vehicles of corresponding capacity. The field ambulance so modified is shown in Appendix "A."

For use with the Tank Brigade, in accordance with modern formations, a cavalry field ambulance is provided. This is unnecessarily cumbersome for service with a formation where mobility is a vital factor and I suggest that it be replaced as early as possible by a unit which I consider would meet all reasonable requirements and is only one-third of its size. The complete composition of the two medical units mentioned is given in Appendices "A" and "B."

If sanction for the formation of these units is given forthwith, their formation will be sufficiently advanced to permit them to take the field with the mobile force on the night of September 19.

My appreciation of the position as regards casualties is as follows: There is very little previous experience to help in the formation of the estimates given, and I would like an expression of opinion by "G" on this point.

(1) An infantry brigade with mechanized transport will fight on foot as ordinary infantry, and consequently the same difficulty as regards collection of casualties as with an ordinary infantry brigade will be experienced. The ordinary field ambulance organization will, therefore, be required.

As used on the present occasion, however, the brigade is not likely to be called on to assault a prepared position or to hold one for any length of time. Its action I understand will be more in the nature of a "tip and run game." Casualties will consequently more nearly approximate to those of a cavalry force, and should not exceed 5 per cent. on an average day's fighting. When used as a raiding force the demands of mobility may be such as to call for serious modification of the treatment of wounded, etc., and on occasion, if fighting in a civilized country, it may be essential to leave the more serious cases to the care of the enemy.

All personnel are provided with accommodation on some vehicle, consequently "sitting" or "walking" cases can be accommodated on the "buses" or other vehicles of the brigade. Ambulance wagons need only be provided for stretcher cases and as feeders of sitting casualties to the bus column. In most cases, the troops will not remain for long in immediate fighting contact with the enemy, therefore bearers will not be required as ambulances can drive to the regimental aid posts.

In view of the above, the ambulance provided for the 7th Infantry Brigade will be organized with a light section which is all that will accompany the brigade on occasions such as these. (See Appendix "A.").

(2) *The Tank Brigade.*—Wounded requiring ambulance accommodation will be very few. If a tank is penetrated by a shell, it will be more a case for the undertaker than for the doctor. Apart from this, the bulk of the casualties will be from small splinters of bullet casing, or from "scaling" or splash from the inner side of the armour. These cases will almost all be classified as "sitting" or "walking" cases and can be accommodated on the vehicle from which the relief is drawn.

Wounded (as apart from dead) I should estimate as not more than 4 to 5 per cent, and the proportion of stretcher cases amongst these as 10 per cent.

Casualties in tanks can only receive such first aid treatment as can be given by the crew. All casualties can be brought to the rallying point and, in most cases, to the rendezvous in the tank concerned.

Should it be essential to clear the tanks for further action, serious cases could be dropped out at the rallying point, and the number and position of these notified to the Tank Brigade Field Ambulance with "B" échelon. If the enemy has been driven off the field, it may then be possible for the ambulance cars of the medical unit to collect these cases. If in large numbers, the mobile dressing station can drive to the spot and treat the cases where they are.

At the rendezvous, the tanks are met by the field ambulance, all cases are dressed in the mobile dressing station, sitting cases transferred to the buses or other vehicles from which the relief crews have been drawn, and stretcher cases placed in the ambulance wagons.

If my estimate of the number and nature of casualties is correct, it follows that of a total strength about 1,440 in tanks not more than 57 to

72 would be wounded, and of these 6 to 7 would be stretcher cases (2 car-loads). This estimate is confirmed by a Staff Exercise in the Southern Command in December, 1932, where a Tank Brigade with accessory units

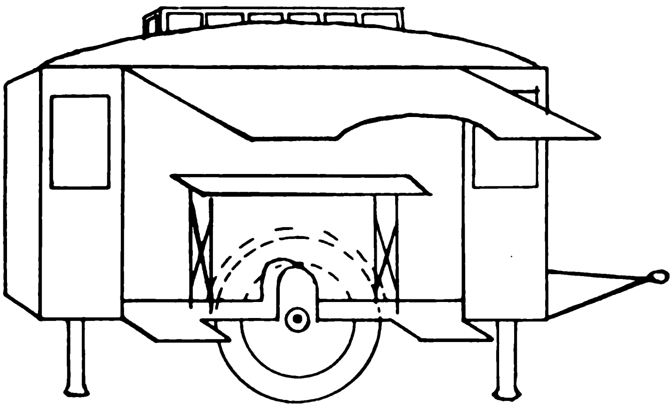


FIG. 1.—Mobile Dressing Station on Trailer.

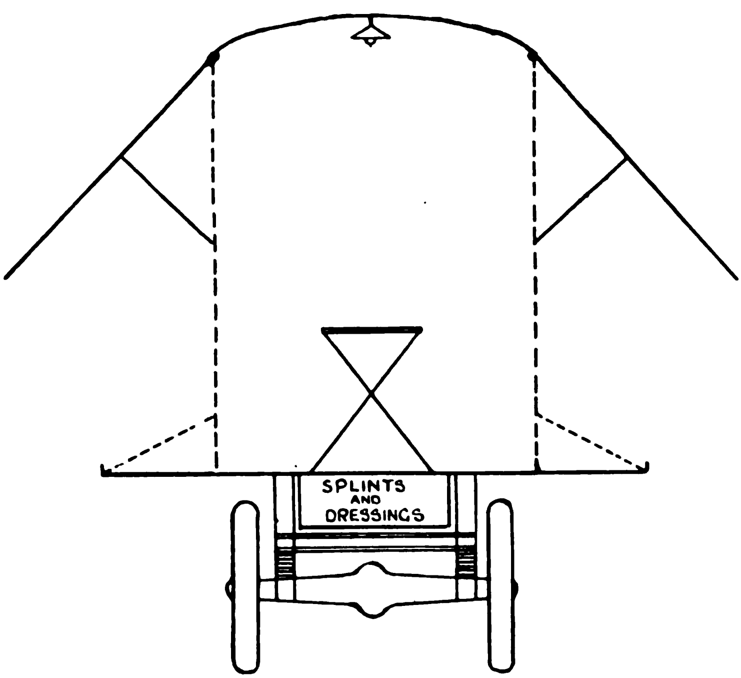


FIG. 2.—Mobile Dressing Station on 30-cwt. Lorry.

in two days' fighting had 75 casualties (equal to 60 wounded). From this it will be seen that a very small medical unit would suffice for a tank brigade. No bearers would be required and very little stretcher carrying capacity. It is essential, however, that the dressing of wounded should be rapidly

carried out, as the time at the rendezvous may be very short, and at the same time the dressing station must be prepared to carry out major (abdominal) operations, as the cases may have to be retained in the unit for several days or, if in a civilized country, left in charge of the local inhabitants.

The dressing station must then be able to come into operation in a few minutes, carry out major operations and still be able to move off at extremely short notice. These requirements can only be met by a dressing station on wheels. When one sees the marvellous caravans that are nowadays built on trailers weighing only a few hundredweight, it will be realized that a little ingenuity could devise a very excellent operating room on such a trailer or on a thirty-hundredweight chassis (see figs. 1 and 2).

This dressing station would carry all the necessary medical equipment in addition to the required staff. A medical unit of the size described, although only one-third of the size of that allotted to a tank brigade in war establishments, could carry out all that is required by considerations of humanity, could efficiently salvage wounded and maintain the morale of the personnel, whilst not seriously interfering with the mobility of the brigade.

Armoured ambulance wagons have been recommended for collection and conveyance of wounded. If plated with armour sufficiently thick to resist a rifle bullet they would either be of enormous weight if big enough to carry four stretchers or else so small as to be worthless on account of their limited carrying capacity.

The medical requirements of an armoured car regiment are very similar to those of a tank battalion. A very small percentage of wounded requiring medical attention is anticipated and all of these can be carried on the car until an opportunity occurs for handing them over to one of the medical units of the force.

In estimating casualties and designing medical units for a tank brigade, wounded only have been considered. My estimate may however be very much upset by the use of mustard gas. From my personal experience of this gas I am convinced that if the outside skin of a tank or armoured car was sprayed with it, all the crew would become casualties unless they immediately abandoned the vehicle until it had been decontaminated. From conversation I have had with members of the Royal Air Force I understand that a line of tanks could be easily sprayed from an aeroplane (each 'plane can carry forty gallons). If this is so the casualties instead of being 4 per cent to 5 per cent may reach 30 per cent or more. It would be necessary to get an authoritative opinion on this point before coming to any definite conclusions as to the amount of ambulance transport required for these units.

(3) *Plan.*

For evacuation of sick and wounded the ambulance should be reorganized as indicated forthwith. As mobility is of primary importance on this raid, only the light section of the 7th Field Ambulance and the

Tank Field Ambulance, less two ambulance wagons and the 2nd line lorry, should accompany the force. This will be ample to deal with the casualties as estimated. Should a large number of gas cases result from an air attack on the column on the march, those which require lying accommodation must be provided for on empty supply lorries, the numbers of which will increase daily.

No special precautions for preservation of health need be considered on a raid such as this.

It is not practicable to encumber the column with extra gas clothing, etc. Should clothing become splashed with mustard gas it must be discarded and the man must do the best he can to acquire other garments from the dead or from civilians, even though this may detract from the uniformity usually demanded.

APPENDIX "A."

7TH FIELD AMBULANCE.

Composition as in War Establishments but:—

6 Limbered G.S. wagons 3 Water carts 1 Maltese cart 1 Officers' mess cart 1 Travelling kitchen 4 Ambulances, horsed, heavy	replaced by	3 30-cwt. lorries 2 Carden-Lloyd utility vehicle 3 Motor ambulance wagons 3 Trailers, water cart 1 Trailer, kitchen

The vehicles of the Field Ambulance then being:—

Bicycle	1
Motor cycles	4
Motor cars (2-seater)	3
Motor cars, light	1
Motor ambulances	9
Lorries, light	8
Trailers, water	3
Trailers, kitchen	1
Carden-Lloyd utility vehicles	2

In addition to these, 4 buses would be required when the Brigade is embussed.
On a raid, etc., when mobility is essential, the following light section would suffice:—

Personnel—	
Officers	7
Other ranks	34
Vehicles—	
Motor ambulance wagons	8
Light lorries	2
Carden-Lloyd utility vehicles	2
Motor cycles	4
Water trailer	1
Bus for personnel	1
Light car	1 (for officers)
Two-seater car	1 (for O.C.)

APPENDIX "B."

TANK BRIGADE FIELD AMBULANCE (2 SECTIONS).

Personnel—

(a) Officers—1 as O.C. Field Ambulance.
2 as Section Officers ("A" Section).
2 as Section Officers ("B" Section).

Total 5

(*b*) Other Ranks—

Royal Army Medical Corps:

- 1 Warrant Officer, as S.M. of Field Ambulance.
- 2 N.C.O.'s, as Section N.C.O.'s.
- 2 N.C.O.'s. } For Mobile Dressing Stations.
- 6 Privates as Nurs. Ord.'s } For Mobile Dressing Stations.
- 15 Privates as Ambulance orderlies (includes 1 orderly for each of the 10 ambulances and 50 per cent spares for casualties, etc.).
- 3 Batmen.

Total 29

(*c*) Other Ranks.

Royal Army Service Corps:

- 1 Driver of O.C.'s car.
- 2 Drivers for Section Officers' cars.
- 4 Drivers of Mobile Dressing Stations.
- 2 Drivers as despatch riders (motor cycle).
- 15 Drivers as motor ambulance drivers (includes 1 driver for each of the 10 ambulances, and 50 per cent spare for casualties).
- 1 Driver for 30-cwt. lorry.

Total 25

Vehicles—

- 10 6-wheeled motor ambulance wagons (5 to each section of field ambulance).
- 2 30-cwt. lorries fitted as Mobile Dressing Stations.
- 2 6-wheeled cars for use of officers.
- 1 2-seater car for O.C.
- 2 Motor cycles for despatch riders.
- 1 30-cwt. lorry (2nd line transport) for spare kits, etc.

NOTE.—3 men on each ambulance wagon, 1 driver and 2 R.A.M.C., or 2 drivers and 1 R.A.M.C., alternatively, all to be trained in first aid and stretcher drill.

Cases from "B" échelon to be cleared by motor ambulance convoy, when supply column comes forward to refill "B."

Contrast—

	Proposed Tank Brigade Field Ambulance	Cavalry Field Ambulance
Personnel ..	54	177
Vehicles ..	18	45

PROGRESS OF MANŒUVRES.

The 7th Infantry Brigade crossed the frontier at 02.00 hours on the 19th, and proceeding on a wide detour via Cheltenham, Burford, Faringdon, arrived at Hungerford shortly after daylight. This town was occupied and held until the night of the 20th. The Tank Brigade left Highnam at 18.00 hours on the 20th, and, less one battalion, proceeded via Cirencester to Hungerford. A battalion of light tanks went via Marlborough to Savernake Forest. In Marlborough they encountered two battalions of infantry with all the anti-tank guns of a brigade. A battle was fought here in which the tanks were declared to have had the following casualties: eight tanks and 40 per cent of "B" échelon. They remained in the forest until the night of the 20th. On the afternoon of the 20th one battalion of infantry was sent from Hungerford to help to hold the forest position.

At about 18.00 hours on the 20th it was decided that if the force was to be back at Minety in condition to take part in the main battle on the 22nd, no further offensive action was possible and the force withdrew during the night of 20th-21st by a still more circuitous route than that by which it had advanced, at first proceeding due east to Newbury and then north to Abingdon and so west and then south to Cirencester and Minety.

Although the great tank action which we hoped to study did not come off, still a number of lessons were learned by the medical units which we hope to amplify next year.

The general conclusions come to were as follows:—

(1) Any medical units to function with a Tank Brigade must be divisible into four independent sections. Tank battalions are despatched on independent subsidiary missions, and even when a Tank Brigade is moving on a single objective different routes may be taken by the various battalions. As will be seen from the unexpected battle in Marlborough any one of these battalions may unexpectedly have a number of casualties. In this case the section of the field ambulance, if with "B" échelon of the light tanks, would probably have had serious casualties itself; still its place was with the échelon.

If the ambulance is to be divisible into four sections one mobile dressing station capable of undertaking major operations should be provided and three of a less pretentious size, the latter possibly mounted on an ambulance wagon chassis.

(2) A large number of lorries would be available for the conveyance of stretcher cases. Much though we may desire to provide every comfort for the wounded, these considerations must give way to military necessity. That necessity in the particular operation was to keep the non-fighting transport as small as possible so as to increase the mobility of the force. In the present mobile force there are already over one thousand such vehicles without counting the transport of the medical services. In the Great War it was not found practicable to use the empty supply lorries for evacuating wounded, but on a raid such as this they can and should be used for this purpose. The lorries in question, as they are in hostile territory, must keep in close touch with the fighting units on all occasions for their own protection. Every day that the force spends away from its base some of these lorries are being emptied of their supplies of ammunition, petrol and rations, and will then be available for the conveyance of stretcher cases. There will be no difficulty about getting into touch with them, as they and the ambulances will move in the same column. This being so, only sufficient ambulance wagons to act as collectors for the lorries need accompany the force. On the raid in question there were 30 lorries available on the first day and 100 by the end of the second day before the withdrawal commenced.

In view of this I consider that only 8 of the 10 ambulance wagons of the Tank Brigade Field Ambulance and 6 of those of the mechanized Field Ambulance should have accompanied the force. The number of ambulance wagons will change with the nature of the operations and when the mobile force is used to roll up the flank of the enemy as was intended on the 22nd inst., all the ambulance wagons of both medical units will probably be required. In such an operation the force will be in closer touch with its base and with other formations of the army, so the number of supply lorries

accompanying it, if any, will be much fewer and the medical units will have to rely on their own transport.

(3) It would appear that the only treatment the wounded in a tank or armoured car could possibly receive during an action and for a short time afterwards would be that which can be given by their comrades. For this reason every man in the Tank Corps and Armoured Car Regiments should be trained in first aid. Training sufficient to enable a man to obtain a St. John's Ambulance Certificate could be given in about twenty lectures of one hour each. This certificate would subsequently be of considerable value in enabling the holder to obtain employment in civil life and every effort should therefore be made to encourage as many men as possible to obtain this certificate.

(4) If, as I am told, the medical officer of a tank battalion cannot be accommodated in an armoured vehicle, so that his services can be utilized at the rallying points, he is of very little use. A further economy may be effected by omitting the medical officer from the war establishments of these units and adding two medical officers to the strength of the ambulance. This would involve the addition of another car for their conveyance, but would release one car from each battalion.

(5) In long drives in a big column of motor vehicles in close formation the effect of exhaust fumes on the eyes and even of carbon monoxide poisoning becomes serious. On the retirement we drove in close formation from 20.00 hours on the 20th to 0.700 hours on the 21st. A large number of men complained of abnormal drowsiness and eye irritation and some were so seriously affected as to require admission to hospital. One man who lay on the floor of a bus was rendered unconscious.

It is hard to see how this trouble is to be avoided. Greater spacing will render the vulnerable "B" échelon dangerously long. It would appear as though the cause of the trouble should be tackled by very careful attention to carburettion. A perfect mixture should result in an exhaust free from carbon monoxide. Some improvements may result from leading exhaust pipes to the top of the vehicle.

(6) The personnel of a tank brigade if caught by the enemy out of their tanks when harbouring may suffer severe casualties and the proportion of wounded, stretcher cases, etc., in that event would be the same as those suffered by infantry. Such an event would, however, be rare and would only be likely on a raid into enemy country.

(7) Those of us who saw tanks in action in France and Belgium must get the pictures formed then out of their minds. The use of tanks in direct support of infantry is contrary to modern ideas. In future they will be employed on raids such as has been described above, acting on the enemy's exposed flanks or to follow up a victory. They will consequently require medical units of their own and cannot rely on help from the Divisional Field Ambulances.

CYSTICERCOSIS (*TÆNIA SOLIUM*).[1]

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AND

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I.—Introduction.

For some years the Consulting Physician to the British Army, Colonel W. P. Mac Arthur, has called attention in the Annual Report on the Health of the Army to the importance of excluding cysticercosis infestation as a cause of epilepsy. In the reports of 1929, 1930 and 1931, he mentioned several cases and pointed out that the importance of cysticercosis as a cause of epilepsy was not sufficiently realized, either in the Service or by practitioners in the tropics.

In 1932, a special investigation was ordered by the War Office. It was laid down that all cases of epilepsy which occurred in soldiers previously healthy who had served abroad should be sent to the Queen Alexandra Military Hospital, London, for special investigation. Colonel R. Priest investigated those cases sent in between August and December, 1932, twenty-six in all, and this work has been continued since then by the writers. Not only epileptics, but many other cases of nervous and mental disease have been examined to exclude cysticercosis. An important part of the work was the tracing of all previously recorded cases of cysticercosis, whether diagnosed in the Army or after they had been discharged or transferred to the Army Reserve. With the assistance of the Secretary

[1] This paper is based on the M.D. Theses submitted by the writers to their respective Universities of Dublin and Cambridge. Received for publication on January 15, 1935.

of the Royal Hospital, Chelsea, and the Ministry of Pensions, the whole of each patient's documents have been available. In all such cases the history has been traced from the day of joining the Army to the time of writing (except for three cases not traced later than 1912, 1925 and 1927 respectively) or to the time of death. Therefore our series includes all the published cases of cysticercosis in soldiers, their wives and children, from 1892 to 1934. The material of other authors has been freely used, and the references to all the previously published cases in English medical literature since 1892 will be found in the bibliography at the end of this paper. In many cases, material information was not available at the time of first publication, but has since been traced with the aid of military documents. In other cases, the patients have been traced up to the present date, or to the date of their death. In the course of the investigation 258 cases have been gone into; 214 of these have attended the Queen Alexandra Military Hospital, Millbank. The remaining 44 patients are those which have been traced from the published records and documents, those that were visited in other hospitals or epileptic colonies and those diagnosed elsewhere whose skiagrams were sent to us for inspection.

II.—Preface.

The recognition of cysticercosis in man is not a new development nor, except in England, America and in those continental countries where sanitation has reached a high level, is it a rare disease. Cobbold of "filaria" fame, in his book on entozoology, published in 1863, gives a good account of the disease with some very shrewd comments on the risk of infestation by uncooked vegetables, water, flies, etc. He stated that over one hundred deaths had been recorded as having been caused by cysticercosis of the brain. Griesinger, a distinguished psychiatrist, collected fifty-six cases of cysticercosis with cerebral symptoms in 1862. He then stated that epilepsy due to cysticerci in the brain is in no way distinguishable from true cerebral epilepsy. Cysticercosis, or somatic tæniasis in man, however, became almost a forgotten disease, especially in England and America, owing to the rarity both of indigenous cases and of *Tænia solium* Linnæus 1758, until the publication of Colonel Mac Arthur's work in 1933 and 1934. Our English textbooks only refer to it very briefly as a condition of extreme rarity.

Even neurological textbooks, except for the time-honoured reference to a cysticercus in the fourth ventricle, do not give the disease any prominence as a cause of nervous or mental symptoms. Foreign textbooks give an extremely good account of the disease. Oppenheimer (1910), and the theses of Volovatz (1902), Vosgien (1911), Schmitte (1928), contain much valuable information. To the modern practitioner the disease is almost unknown. It has become to a great extent a tropical disease, found in this country chiefly among soldiers, their wives and families, who have served in the countries where sanitation has not reached the same standard as in England.

III.—Definition and Synonyms.

By cysticercosis (κύστις bladder, κέρκος tail) is meant the presence of cysticerci in the tissues of man or animals. Cysticerci are the larval forms of certain cestodes.

There is no satisfactorily proved case of *Cysticercus bovis* in man, so that for all practical purposes human cysticercosis is always due to the presence of *Cysticercus cellulosæ* in the tissues. Human cysticercosis, therefore, results from man becoming the intermediate host of *Tænia solium* instead of only the definite host, the resulting disease being known as cysticercosis (*Tænia solium*) or somatic tæniasis. The word cysticercosis applied to pigs is synonymous with "swine measles" in England, in France with "ladrerie"; in Germany the *Cysticercus cellulosæ* in pigs is called "finne" and the disease in man "finnen Krankheit." The word is often written "Zysticerken." In Holland the cysticerci are known as "gortleid." In Italy, pigs infected with cysticerci are termed "lazaroli." The ancient Greeks called the disease in pigs "chalaziasis" (χάλαζά hailstone), from the resemblance of the cysticerci in pork to hailstones. The Romans referred to the cysticerci as "glandines," and the disease among pigs as "morbus glandulosus." There was much confusion in earlier days, and the word "measly" in England and "ladrerie" in French, are often applied to other conditions. Cysticercosis is said to be generalized when cysticerci are found all over the body, and localized when they are confined to a single organ, such as the eye, heart, brain, etc. In our experience cysticercosis in man is nearly always generalized.

IV.—Historical.

(a) *Recognition of Cysticercosis in Animals.*

Cysticercosis in animals has been known for centuries. The Egyptians, according to Heredotus, recognized cysticercosis in beef. Aristophanes in "The Knights" refers to it and to the method of examining the pig's tongue and mouth for the characteristic vesicles, a practice which is in vogue to-day and is known in France as "langueyage." Aristotle, in the "History of Animals," gives an excellent description of cysticercosis in the pig. He states that it is only found in young pigs; a fact which is borne out by modern experience: experiment shows that older pigs cannot be infested with the larval form of *Tænia solium.*

Plutarch stated that the reason the Jews did not eat pork was probably a religious one; but that the fear of catching some disease, such as "humors" or "eruptions," was probably an additional reason. Tacitus, quoted by Ostertag, says that the fear of "lepra arabum" was one of the reasons, apart from the religious one, that caused the Mosaic laws against pork. The Koran apparently copied the Jewish laws against pigs. Curiously enough pork was considered a great delicacy by the Romans, but they had excellent slaughter-houses, meat booths and meat inspectors. The Greeks also had market police ("agoramoi"), whose duty it was to prevent the sale of diseased meat.

The first laws regarding meat inspection in Great Britain appear about 1153 (Ostertag). Haworth, in his book on meat inspection (1918) refers to a statute of Edward II (1302), in which the sale of "swine flesh meazled" was prohibited. In the time of Richard III (1484) came good men of the Mystery of Butchers to petition the Lord Warden among other things "That the Wardens (of the butchers craft) be authorized to search for all manner of boores and hogges brought hider here to be sold or occupied and all such boores and hogges as they finde mesels or otherwise unwholesome for mannys body, frealy to seize them and forfeit them and order them to be cast away."

Meat inspection was carried out by the craft guilds and the Worshipful Company of Butchers. It is extremely improbable that anything but a perfunctory inspection was made until recent times. Until 1862, probably one-fifth of the common meat of the country, including pork, came from animals which were considerably diseased, and there was no effective obstacle to such meat appearing on the market. Modern legislation began in 1835 when the municipal corporations made it lawful for the council of any borough to make bye-laws. Meat inspectors were known as "carniters," "flesh conners," etc. Meat infested with measles could be sold in a special place called a measly booth, provided it was not too heavily infested. In France, until recent times pigs were inspected by special men called "langueyeurs," whose duty it was to examine the tongue and mouth of the pigs for any evidence of infestation with cysticerci.

The present high standard of meat inspection in England is due to the fundamental fact that only a two-grade basis exists; whereas in many European countries there is a three-grade basis. The two grades are: (*a*) Meat which is unconditionally passed as fit for human consumption; and (*b*) all other meat which is condemned as unfit. In countries with a three-grade standard, two grades accord with the English requirements, whilst the intermediate grade allows of meat, which would be condemned and destroyed in this country, being sold under defined conditions, either in the fresh state or after having undergone an approved form of treatment. In certain countries on the Continent the intermediate grade includes parts of the carcase which have suffered from measles. The sale of this meat is restricted to special premises which receive the name of "Freibank." It is intended for consumption by the actual purchaser and no hotel, restaurant or eating-house keeper may purchase it, since the character of the meat could not be declared to the consumer.

In the United States of America, the intermediate grade is a comparatively recent development; it is limited in its application and the method of sale differs from European practice. Pig carcases showing a minor degree of infestation with *Cysticercus cellulosæ* may be approved for sterilization after having undergone a process of pickling or refrigeration with the removal of the recognizable affected parts. Food thus treated may only be sold under declaration.

In England it is not permissible to use any carcases showing generalized cysticercosis for human food. Howarth (1918) states that measled pork is only rarely met with but the slightest sign of the presence of parasites would result in condemnation.

(*b*) *Recognition of Human Cysticercosis.*

In 1558 Rumler found in the dura mater of an epileptic priest small pustulous tumours. "The skull having been opened numerous vesicles were found on the dura mater. This was destroyed in numerous places through which the brain protruded."

In 1650 Paranolus saw cysts on the corpus callosum of a patient who had died in a fit. "A priest became unconscious at the end of mass and died in an apoplectic attack. Some time afterwards when the skull was opened there were found in the corpus callosum several small round white bladders which were regarded as the cause of death." Leuckhart quotes the case observed by Wharton (1656): "de glandulis sanis varas corporis partes occupanibus in milite," as obviously referring to bladder worms. A further study, however, of Wharton's own description of the glands which were removed shows that he stated that "they consisted of wholly solid glandulous and white flesh." Colonel Mac Arthur considers that this identification as cysticercosis is erroneous and that the bodies in question were undoubtedly fibromata or lipomata.

(*c*) *Recognition of the Parasitic Nature of the Cysticercus.*

Hartman in 1685, working on cysticerci in a hare, suspected the parasitic nature, for by plunging the cysticerci into warm water he found they moved. He gave them the name of the "bladder worms." In 1693 Redi and Malpighi, working on pigs, and Tyson, working on antelopes, confirmed the observations of Hartman. Goeze, in 1784, described the bladder worm in the pig. In 1786 Werner found bladder worms in the pectoral muscles of a soldier similar to those found by Goeze in the pig and gave them the name of "finna humana." In 1809 Rudolphi gave the bladder worm the name *Cysticercus cellulosæ*, which is still used.

(*d*) *Recognition of the Connection Between the Cysticerci and Tapeworms.*

In 1885 Kürchenmeister produced evidence that the *Cysticercus cellulosæ* was the larval form of *Tænia solium* by giving a prisoner condemned to death, cysticerci from a pig and recovering a *Tænia solium* from his intestine after death. This experiment was confirmed by many others. Since then the study of cysticercosis has entered on a new phase and reports of human cysticercosis have appeared in medical literature from all over the world. Cobbold in English medical literature appears to have been the first to draw attention to the danger of human infestation resulting from the ingestion of tape-worm eggs. In the "Entozoa" 1864, he gives a description of cerebral cysticercosis now recognized as a classical one. He draws attention

to the fact that the eggs of *Tænia solium* may be conveyed to the human host by means of water or flies.

Notwithstanding that our methods of diagnosis became more efficient on account of the use of X-rays, little was added to his description over a period of seventy years. Unfortunately Cobbold's work has been almost forgotten and although occasional cases of cysticercosis were reported in English medical literature, the full significance of the condition, especially in connection with epilepsy, was not realized until the publication of Colonel MacArthur's papers "Cysticercosis as a Possible Cause of Epilepsy," 1933, and "Cysticercosis as seen in the British Army," 1934. These two papers marked a definite advance in our knowledge of the methods of diagnosis, dissemination and pathology of the disease. Foreign literature nevertheless abounds in reports of human cysticercosis. Bruns, in 1906, described certain signs which he considered pathognomonic of a cysticercus in the fourth ventricle. Moss, at Vera Cruz, 1911, described eosinophils in the cerebrospinal fluid as being diagnostic of the disease. We have been unable to demonstrate this in any of our patients though we have records of two such cases published in England.

V.—Natural History and Development.

(*a*) The life-history and description of *Tænia solium* is dealt with in the helminthology textbooks so that a short account of the life cycle with special reference to the presence of the larval state in men is all that is attempted here.

Man is the exclusive host of the adult tapeworm and it is the pig that usually acts as the intermediate host. The worm is attached to the upper part of the intestine by means of four suckers and a double row of alternating large and small hooks; the segments or proglottides grow down from the head till the worm may have as many as 800 or 900 segments and be two or even three metres in length. The proglottides are passed during defæcation usually in groups of 5 or 6 and each proglottis may contain from 30,000 to 50,000 eggs. *Tænia solium* and *Tænia saginata* Goeze, 1782 can be distinguished by the respective number of the lateral branches of the uterus which in *Tænia solium* presents 7 to 12 such branches and in *Tænia saginata* 15 or more. The eggs are set free by rupture of the proglottis, they are spherical and contain a minute hexacanth embryo which is about 14 μ in diameter. The eggs can live at any rate for three weeks on grass or soil, probably longer. When ingested by the intermediate host, usually the pig, but not infrequently man, the hexacanth embryo escapes and with the assistance of its hooks makes its way through the intestinal wall and passes into the blood-stream or the lymph channels eventually to find some resting place in the tissues. Brumpt holds that the great majority of hexacanth embryos die soon after entering the blood-stream and only a few remain to develop into cysticerci.

On arrival in the tissues, the cells in the centre of the embryo proceed

to liquefy and the embryo increases in length, finally consisting of a mass of peripheral cells with a central cavity. Then a small invagination takes place in the wall of the embryo; at the bottom of this invagination a scolex or head is produced complete with hooks and suckers, thus forming a spherical bladder with a single invaginated head. The rate of growth in pigs (and presumably it is the same in man) has been found by experiment to be as follows (Gerlach). At nine days after infestation the larva forms an oval vesicle 0·033 by 0·24 millimetre. At twenty days it is as large as a pin's head with the rudiment of a scolex visible. At thirty-two days the ellipsoidal cyst measures 1 to 6 by 0·7 to 2·5 millimetres, the rudimentary scolex being about the equator. At forty days the size is that of a mustard seed, the scolex having rudiments of hooks and suckers, and traces of surrounding fibrosis appear. At sixty days it is as large as a pea, complete with hooks and suckers surmounting a neckless scolex. At one hundred and ten days the scolex has a complete neck. The mature cysticercus forms an ellipsoidal, semi-transparent cyst measuring from 6 to 12 by 5 to 10 millimetres, the scolex showing through as a whitish spot; the rostellum, armed with 22 to 24 hooks alternating in two rows of different sizes surmounting 4 suckers. The whole constitutes the fully formed scolex of the future *Tænia solium*. It must be understood that these measurements refer to experimental rearing of bladder worms in the pig, which is the normal host, the same does not necessarily apply in the case of man, who is the accidental host.

In many of our cases the size of the fully mature cysticercus has been much larger than 10 millimetres; in one case it was 25 millimetres in length. Experiments in pigs show that cysticerci of equal age were not of equal size in different parts of the body, and there are sometimes larger and smaller bladder worms side by side, yet one cannot distinguish them either in age or in phase of development. The size in man is usually, on an average, about that of a pea or small bean, but it is very variable. In the situations where pressure is equal on all sides, such as the eye, the cyst is spherical. In the muscles, where it usually lies in the long axis between the fibres, it is ovoid or elliptical. In those organs where it cannot develop freely it becomes very irregular, e.g. at the base of the brain, where it may assume a racemose form.

This racemose form occurs at the base of the brain where the cysticercus is compressed between the hemispheres and the base of the skull, and as a result is flattened and elongated and pushes prolongations in all directions wherever there is a free surface. It is completely deformed and instead of being ovoid or spherical, which is the usual form in the cerebral hemispheres, it resembles a bunch of grapes with secondary bladders joined by a pedicle. These forms can attain great length up to twenty to twenty-five centimetres, but the head remains constantly small. It would appear that the bladder of the cysticercus in its racemose form develops at the expense of the head. Frequently in these forms the head cannot be found, hence

they are termed "acephalocystic forms." The racemose form apparently does not calcify.

These forms were first recorded by [illegible] and [illegible] in [illegible]. Zenker in 1882 gave the best description which is accepted above and called the form *Cysticercus racemosus*. He divided them into four groups: Festoon, Pflaumenartige, Ausbreitung, Formes en grappe. [illegible] case of *Cysticercus racemosus* has been found in our series.

1. *Location and Number of Cysts.*

These are very variable. The largest number of cysts was recorded by Blair 1903, where over 5,000 in all were found post mortem in a Kafir who died insane. The case was not diagnosed before death. In our series the largest number reported in the brain was 800. With the increasing use of radiology in the diagnosis of cysticercosis it has been found that the numbers of cysts may be much greater than was at first supposed. When the diagnosis rests upon the finding of a single cyst there is now good reason to believe that many more will often be found if systematic X-ray investigation is undertaken, but cases do occur where the number of cysts demonstrable is very small. The general opinion is that the optimum sites for the parasites are above the diaphragm level in the arms, muscles of the trunk, neck and in the brain. This has been so with most of our cases but sometimes where infestation has been heavy numerous calcified cysts have been found in the muscles of the thigh. The larva of *Taenia solium* may live for a long time in man. A case has been reported of a woman who had a cysticercus living in her eye for twenty years. In most of our cases the cysticerci were dead, degenerated or calcified when removed.

2. *Methods of Infection in Man.*

Man may become the host of the larval form of *Taenia solium* by the ingestion of food or water contaminated directly by human excreta or indirectly by flies. As each tapeworm segment may contain from 30,000 to 50,000 eggs, the possibility that food or water may become contaminated in countries where sanitation is bad is obviously considerable. It is also possible for the host of a tapeworm to infect himself either from his contaminated hands or clothing or by regurgitation of ripe proglottides of *Taenia solium* into the stomach.

To be continued.

THE PROBLEM OF CHRONIC FRONTO-ETHMOIDITIS.

By Major C. A. HUTCHINSON,
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Two sweeping statements—"Once a nose, always a nose," and "Sinusitis cases don't do well in India"—prompted the author's curiosity; and the results of treatment along the lines indicated below have led him to doubt their veracity, and inspired this article.

It is uncommon for inflammation to be present in the cells of the ethmoidal labyrinth without there being a similar causative or associated condition in the neighbouring paranasal sinuses as well. In this article the frontal sinus and anterior and posterior ethmoidal cells will alone be considered.

Anatomy.

The anatomy of the areas under consideration need not be discussed in detail: it will be sufficient to state that the ethmoidal cells are divided into the anterior group, opening into the middle meatus under cover of the middle turbinate and situated in close relation to the fronto-nasal duct, and the posterior group opening into the superior meatus. Numerous atypical outlying cells are frequently present, coming from one or other group and invading the crista galli of the ethmoid, the orbital plate of the frontal bone, the frontal process of the maxilla, the orbital plate of the maxilla and the body of the sphenoid.

The frontal sinus is extremely variable in both its vertical and horizontal extent, and it may be very loculated.

The mucosa lining the frontal sinus and the labyrinthine cells is covered with ciliated columnar epithelium and bears scattered mucous glands, which tend to be more numerous in the region of the ostia, where the mucosa is directly continuous with that of the nasal cavity.

The anterior and posterior ethmoidal arteries are the main source of blood supply to the fronto-ethmoidal region.

The venous drainage is mainly via the spheno-palatine foramen to the pterygoid plexus; branches, however, also join the superior ophthalmic vein in the orbit and the anterior facial vein. There are thus direct or indirect connections with the cavernous sinus on the one hand and with the internal jugular vein on the other.

The lymphatics drain to glands situated at the vault and upper lateral walls of the pharynx; and the perineural lymphatics of the olfactory nerves (which lie in relation to the medial aspect of the upper half of the middle turbinate) open directly via the lamina cribrosa into the pia-arachnoid space.

The frontal sinus derives its sensory innervation from the ophthalmic

division of the fifth cranial nerve, via the supraorbital branch of the frontal nerve; the ethmoidal cells are supplied by the naso-ciliary branches of the ophthalmic division, and by the orbital and postero-superior nasal branches of the spheno-palatine ganglion, and thus from the maxillary division as well.

Pathology.

Chronic fronto-ethmoiditis is the result of acute inflammation in this area which has either been neglected or has not received adequate or efficient treatment; the acute attack having frequently been a complication of an acute specific fever, particularly influenza.

The round-celled infiltration of the acute stage undergoes organization with a resultant thickened polypoid-like mucous membrane, partial obstruction of the ostia and inefficient drainage. Well-formed polypi are often found projecting from various portions of the membrane, which may be thrown into folds by unequal contraction of the organizing connective tissue. An underlying rarefying osteitis is not infrequently present, resulting in time in a more or less wholesale destruction of the bony walls. Lastly, the pathological mucous membrane is bathed in a discharge varying in nature from sero- or muco-purulent to frankly purulent.

At each exacerbation, œdema tends to obstruct still further the already narrowed ostia and may produce complete occlusion of the latter.

While the polypus formation, suppuration and osteitis are usually all present, one or other may tend to predominate in an individual case.

Spread of Intracranial Pyogenic Disease from Infected Paranasal Cavities.

The results of an investigation carried out by Logan Turner and Kennedy in 1931 showed that there are three probable ways of spread: (1) By loss of bone continuity from operative trauma or inflammatory erosion; (2) by septic thrombosis, embolism, or bacteriæmia; (3) along the perineural lymphatics of the olfactory nerves.

When cario-necrosis of the posterior (cerebral) wall of the frontal sinus has resulted from suppurative inflammation within its cavity, pus can reach the leptomeninges by infiltration through the dura. The infection, previously chronic or "restrained," may become fulminating in type, producing leptomeningitis; operative trauma is not infrequently the determining factor in initiating such active and rapid spread. Less frequently, when such spread is slow, adhesions form between the dura and the brain, localizing the infection, which then advances into the brain substance causing an abscess.

A septic embolus, originating in a minute vein from a paranasal sinus, may extend along a perforating osseous vein into the dural veins, and so into the pial vessels direct or via the dural sinuses. The cavernous sinus usually becomes infected via the blood-stream by extension or embolism;

while this is more likely to happen in a case of acute sinusitis, it can also take place when the infection is a chronic one.

General blood infection can occur without there being any thrombosis of the intracranial blood sinuses.

The organism responsible for intracranial spread is almost invariably a streptococcus.

Out of a total of 55 cases investigated, the primary focus was in the the paranasal sinuses in 45. Of these 19 were the result of spread via the blood stream; 20 cases were the result of direct extension through the bone; 8 cases resulted from a combination of these; the balance were of indeterminate origin.

Out of many hundreds of cases recorded, the percentage of *spontaneous* intracranial complications was: In acute sinusitis, 2·5 per cent.; in chronic cases, 0·66 per cent. The percentage of *post-operative* intracranial complications in acute sinusitis was 0·0 (not operated on in the acute stage) and in chronic cases 0·8.

Sixty per cent. of post-operative complications occurred after transnasal approach, and by far the majority were cases of general blood infection. The great majority of complications occurred when multiple cavities were infected, but all such infected cavities were not operated on at the same time; either the raw surfaces of the operation areas became infected by the contact of septic discharges from an untouched cavity, or the inevitable operative trauma stirred up the infection in one of the cavities not interfered with.

While statistics are open to grave misinterpretation, even so the above investigation undoubtedly makes out a very strong case for free exposure of the whole area, the establishment of good drainage, and radical methods.

SYMPTOMS.

The condition may be entirely latent and may only be revealed in the course of examination to elucidate the origin of such conditions as rheumatic affections, indigestion, bronchial catarrh, laryngitis, inability to concentrate, failure of bodily and mental vigour, visual disturbances, neuralgia, &c.

On the other hand, the following are the symptoms for which the patient may seek advice:—

Nasal Discharge.—Catarrh is complained of when the ostia are patent. It is more troublesome in the early part of the day and may be got rid of by blowing the nose. More usually, however, the concomitant nasal obstruction causes it to drip backward into the nasopharynx, etc., and the chief complaint is of "morning hawking," while there is a tendency to distressing crust formation.

Nasal Obstruction.—This is present in varying degree, and may be due to the presence of polypi or to œdema of the inferior and middle turbinates. It is apt to be aggravated when the patient is lying down and varies with the position adopted.

Headache and Pain.—These are very variable and may be absent throughout the whole course of the affection.

Tilley and Wilfrid Harris point out that the most frequent complaint is of a sense of fullness in the region bordering the inner side of the orbit and at the root of the nose, and of a sense of pressure over the vertex; both relieved by cocainizing the upper anterior regions of the nasal fossæ.

A dull type of frontal headache with a marked tendency to morning periodicity may be present, and use of the eyes increases it, while it is also increased by pressure over the sinus floor.

Headache may be more diffuse, and is sometimes referred to the occipital region, but usually tends to be unilateral; when, therefore, generalized headache is complained of, either there is general toxæmia or bilateral sinus involvement.

It should be remembered that there may be some cause for headache quite independent of a local chronic inflammatory lesion. It is therefore essential that a preliminary overhaul of the patient be made, especially as regards heart, lungs, blood-pressure, kidneys and bowels.

Anosmia, halitosis, vertigo and tinnitus are less common symptoms.

SIGNS.

A careful examination of the patient should be made by both anterior and posterior rhinoscopy after preliminary cocainization; while direct examination with a nasopharyngoscope is of great value.

Pus.—The discovery of pus in the middle meatus by anterior rhinoscopy indicates involvement of the anterior group of paranasal cavities. It tends to run down over the anterior end of the inferior turbinate when coming from the anterior ethmoidal cells or frontal sinus; but to run down over the middle of this structure when coming from the maxillary antrum. (A negative result of proof-puncture definitely excludes the latter.)

A fleeting glimpse of pus in the middle meatus, when coming from the same sources, may be obtained by posterior rhinoscopy.

The discovery of pus in the olfactory cleft by anterior rhinoscopy, and in the superior meatus by posterior rhinoscopy, indicates that the posterior ethmoidal cells are involved.

When suppuration is present in the sphenoidal sinus, the pus will be found adhering to the vault of the nasopharynx and may show "crusting"; while it also tends to appear as streaks in the line of the ciliary flow from this sinus (i.e. horizontally to a point above and behind the eustachian orifice and then down into Rosenmüller's fossa).

The nasal picture is, however, a very variable one, and signs of diagnostic significance may be present at one examination and absent at the next. Accordingly, in the absence of pus it must not be assumed that there is no need for further investigation.

Œdema.—Œdema of the mucous membrane over the anterior end of the inferior turbinate or the uncinate process should suggest the existence

of purulent discharge as the causative source of irritation. So-called "mulberrying" of the posterior end of the inferior turbinate has the same significance.

Polypi.—These are usually found in the region of the middle turbinate and perhaps filling the nasal cavity. When multiple they indicate the presence of chronic ethmoidal infection. They may be present with or without recognizable pus in the nasal cavity.

Fistula formation and meningitis are other occasional findings.

Special Methods of Examination.

Lavage and Exploral Suction.—These are of some use in the case of the frontal sinus, but quite useless for the ethmoidal labyrinth owing to the structural difficulties encountered.

Transillumination.—This is of very little use except in the case of the frontal sinus and even then is merely suggestive.

X-ray Examination.—Radiograms are of the utmost value: (*a*) for diagnostic purposes; and (*b*) as a guide at operation to the presence, extent, and loculation or otherwise of the frontal sinus, and to the position and extent of the ethmoidal cells.

The use of a Potter-Buckey diaphragm is essential to secure the very fine definition required; and a standardized technique with standard positions is absolutely necessary for accurate diagnosis.

The Graham-Hodgson technique fulfils admirably all requirements; his most useful positions being: (1) True lateral; (2) occipito-mental, by which dissociation of the shadows of the frontal sinus, anterior and posterior ethmoidal cell-groups is secured; (3) right and left obliques for the examination of the posterior ethmoidal cells.

The Americans favour the use of lipiodol and radiography to determine the extent to which the mucosa of the frontal sinus is thickened.

Treatment.

Tilley [1] has pointed out that temporary or permanent inhibition of the ciliary action in the nasal or paranasal cavities leads to retention of inflammatory products, with pain and other clinical manifestations as probable consequences. While every effort, therefore, must be made to establish free and spontaneous drainage for pathological secretions, equal care must be taken to preserve any inflamed mucous membrane which appears to be capable of ultimate recovery. Neglect of this precaution may cause pain resulting from obstructive scar-tissue and intolerable crust formation.

J. G. Hunt [2] points out that the treatment of chronic fronto-ethmoiditis is too often empirical, and he emphasizes the necessity of first determining the degree and type of the pathological changes in the mucous membrane before beginning treatment; failure to do this is, in his opinion, the cause of the frequent disappointing results of repeated drainage operations and excisions of polypi.

The various lines of treatment in vogue may be classified as :—

(*a*) *Non-operative*, including vaccine therapy, light therapy, vitamin-containing foods, irrigation, astringent applications, cauterization, sclerosing injections and ionization.

(*b*) *Operative*, including extensive submucous septal resection, trans-nasal drainage operations and extra-nasal operations for the complete removal of diseased tissues.

To comment on the above :—

Vaccine Therapy, Light Therapy and Vitamin-containing Foods.—These cannot possibly restore to normal or sterilize the thickened mucous membrane in the cavities under consideration.

Irrigations.—These are obviously futile when chronic pyogenic infection has resulted in polypoid or fibrotic degeneration of the mucous membrane, as fluids are usually unable to pass through the congested and obstructed ostia, and even if they do, merely tend to increase the waterlogging of the tissues, with aggravation of the condition.

Astringent Applications to the Turbinates.—These may, to a slight extent, improve drainage, but even this mild benefit is of very transient duration.

Cauterization of the Turbinates.—This has the same end in view, but also affords merely transient benefit. Cauterization results in destruction of the ciliated epithelium, which is replaced by that of stratified squamous type; repeated cauterization, indeed, so interfering eventually with the ciliary stream that there is an increased tendency to "crusting," and finally the nose may pass into the state of atrophic rhinitis.

Sclerosing Injections of the Turbinates.—These will to some extent improve drainage without producing such disastrous results, but are of strictly limited applicability.

All the last three methods have the additional disadvantage of in no way touching the primary causative focus—the pathological condition present in the paranasal cavities.

Ionization.—This is of undoubted benefit in the treatment of an inflamed mucous membrane, but the *sine qua non* for its effective action is that there shall be free access to all parts of that membrane and facilities for removing supernatant purulent matter before commencing this line of treatment; and these desiderata are only available after the establishment of free drainage and aeration.

Intranasal operations for the relief of the nasal obstruction produced by chronic sinusitis (e.g. removal of polypi, subtotal turbinectomy, etc.).

These are irrational as they do not remove the cause, and they may be dangerous, when associated with post-operative packing, owing to the risk of producing secondary hæmorrhage, generalized suppurative rhinitis and even acute otitis media.

There remain to be discussed the various drainage and radical operations.

Success in sinus surgery varies directly with the surgeon's ability to locate the diseased cells and to appreciate the treatment called for in each individual case.

Every patient with chronically diseased sinuses does not require a radical operation and the following outlines may help to indicate the procedure advisable under various conditions.

(1) *When the disease is quiescent and only accidently disclosed by X-rays.* Such cases are best left alone.

(2) *Patients in good general health, but with slight catarrhal symptoms.* These are best treated symptomatically.

(3) *Cases where the symptoms are so severe as to necessitate surgical intervention.*

(*a*) *When the infection is limited to the anterior ethmoidal cells.*

Mosher's method of transnasal approach with removal of the Agger nasi cells and uncapping of the cells of the anterior group will frequently suffice. It should be preceded by removal of the antero-inferior part of the middle turbinate.

Cutting forceps should be employed, with avoidance of all curettage. If bleeding is excessive, the operation should be done in stages.

The application two weeks later of cocaine and adrenaline to shrink the œdematous tissues, and then touching the granulations with five to twenty per cent. silver nitrate helps to prevent excessive cicatrization with reclosure of the drainage established.

(*b*) *When the infection is mainly limited to the frontal sinus, with obstruction of the frontal-nasal duct and involvement of the anterior ethmoidal cells adjacent to it.*

Very varying views are held as to the best method of procedure in such cases.

Coakley [3] favours transnasal approach via Mosher's route, uncapping the cells involved, and, when necessary, rasping away the nasal crest. He does this under "local anæsthesia" by "blocking" Meckel's ganglion and cocainizing the nasociliary nerves. In the after-treatment he deprecates the introduction of drainage tubes, and advises periodical irrigations starting in the second week and the occasional passage of Watson Williams' bougies.

Douglas Harmer [4] prefers preliminary removal of the antero-inferior part of the middle turbinate, transnasal uncapping of the anterior ethmoidal cells, and subsequent performance of the Barwell operation on the sinus. In this last-named operation a small funnel-shaped opening is made in the anterior wall of the sinus, and passive dilatation of the fronto-nasal duct is subsequently secured by the use of successively larger rubber catheters, the first of which is introduced via the nose at operation and anchored in place.

In both the above methods there is, however, risk of leaving behind thickened mucosa, with the probability of subsequent exacerbations.

Logan Turner [5] is of opinion that transnasal approach to the frontal sinus may occasionally suffice; but that it should be reserved for cases in which the sinus is of average size, is not loculated, has no obvious orbital

extension, and has not as yet got appreciably thickened mucous membrane, while there must be considerable space available between nasal and frontal cavities for instrumentation. For all other types of sinus, especially if associated with ethmoidal suppuration, he favours external approach.

Lewell [6] of San Francisco does not advocate transnasal surgery for chronic frontal sinusitis. He holds that if there is necrosis of the outer table or an acute osteomyelitis, extremely radical external operation is called for, with obliteration of the cavity by allowing the forehead tissues to fall into the depression and fill it completely. This, however, results in a cosmetic catastrophe.

There are two other external operations, the Killian and the Howarth; both will be referred to later.

(*c*) *When both anterior and posterior ethmoidal cells are involved, but the frontal sinus has apparently escaped.*

It should be borne in mind that repeated minor operations are unsatisfactory and ill-tolerated by the patient, who becomes more and more unwilling to face the knife.

More or less radical transnasal operation may sometimes suffice, the choice lying between the Sluder operation and the Sluder-Hajek. Both can be done under "local anæsthesia" as indicated above, Lithgow advising a preliminary dose of nembutal.

The Sluder operation is, however, dangerous, as it involves complete removal of the middle turbinate, with division of the olfactory nerves and opening up of the perineural lymphatics, and these, as has been pointed out, communicate directly with the subarachnoid space.

In the Sluder-Hajek, on the other hand, merely the lower half of the middle turbinate is removed, and accordingly the olfactory area is left intact.

The disadvantages common to both operations are that it is not easy for the surgeon to see what he is doing, hæmorrhage may be troublesome, while unforeseen accidents with intracranial complications, extravasation into the eyelids and orbital cellulitis may all occur. External approach will obviate the above difficulties and is accordingly more popular with the majority of rhinologists.

(*d*) *When both anterior and posterior ethmoidal cell groups are involved together with the frontal sinus.*

The chief desiderata for radical operations on the fronto-ethmoidal region are that there shall be: (*a*) Complete exposure of the whole interior of the sinus; (*b*) free access to the infected ethmoidal cells, as the removal of all thickened polypoid mucous membrane is the only effective measure for this otherwise intractable disease.

(*To be continued.*)

AN IMPROVISED SHELTER FOR USE WITH A FIELD AMBULANCE.

By Major W. L. SPENCER COX, M.C.,
Royal Army Medical Corps.

The construction of the improvised shelter described in detail below was worked out during the training of a composite field ambulance at Bures Camp, Suffolk, during August and September, 1934, and was originally intended for use as an advanced dressing station.

The transport given to "A" Company of the composite field ambulance consisted of two 30-cwt. lorries in lieu of three limbers.

From an administrative point of view this was most convenient, since the lorries could carry the three limber loads of company equipment, the men's greatcoats and blankets, as well as rations and fuel.

The Company was, therefore, self-contained, and in the event of its becoming detached from the ambulance, there was no necessity to send forward supplies, etc., from headquarters before settling down for the night.

Unfortunately, however, it was found that this arrangement was unsatisfactory when the ambulance was working in combined exercises with other troops. Being motor vehicles these lorries had to move in rear of "B" échelon transport and were not allowed to march with the company, with the result that they frequently became separated and the company was deprived of its stretchers and equipment when required to come into action and collect wounded.

In the light of the experience gained during these manœuvres it is probable that 30-cwt. lorries will not be used again for company transport, and until some form of motor transport is brought into general use, we shall have to be content with limbers.

This point has been stressed at some length because two 30-cwt. lorries are essential for the construction of this shelter, but at the same time, since lorries will always be a part of Headquarters transport, it was felt that a description of its construction might still be of interest for training purposes.

An advanced dressing station in time of war will probably always be situated in a building of some description, while in stationary warfare old trenches, pillboxes, dugouts, or even a sheltered quarry might be used, but for peace-time training, what shelter is there? The equipment of a company contains no tentage, and in general, buildings, unless specially hired for the purpose, will never be available in a training area.

Further, in view of the speed of erection, the shelter might also prove useful to Headquarters when an ambulance is on the move and the few

casualties filtering through do not justify the opening up of a main dressing station to its full extent. Imagination and assumptions are poor substitutes for concrete fact in the training of young soldiers and an imaginary building covering a neatly laid-out dressing station is a particularly poor substitute on a wet night in an open field.

It was with this object in view that the following detail was worked out.

Equipment.

All the equipment required is contained in the camp equipment of a field ambulance and can be drawn from the quartermaster's store, i.e. :—

Tarpaulin, black, 30 ft. by 30 ft.	1
Drag ropes, prs...	6
Posts, picketing	6
Pegs, tent, large	12
Pegs, tent, small	24
Maul	1
Mallet	1
Marquee curtains, single	2
Tarred string	Q.S.

Two 30-cwt. lorries from Headquarters transport carried the above equipment in addition to that of the entire company.

Personnel.

The personnel used for construction (*vide* War Establishment of a Field Ambulance. Composition in detail) was :—

Nursing Orderlies: serjeant, corporal and two privates; Clerk: corporal; Wagon Orderlies: two privates—total seven; assisted by the two M.T. drivers, R.A.S.C.

It was found that with a little practice this team could erect and lay out the equipment in six minutes, and strike, pack up and be on the move in fourteen minutes.

Method of Erection.

The "drill" which was found to be most successful was as follows :—

Two small tent pegs were driven into the ground twenty feet apart and the lorries lined up exactly parallel with the centre of the front wheels resting against the outer side of the pegs. The tarpaulin was carried out and unfolded between the lorries and drag ropes attached to the loops. These were thrown across the lorries and with a little manœuvring the tarpaulin was drawn taut.

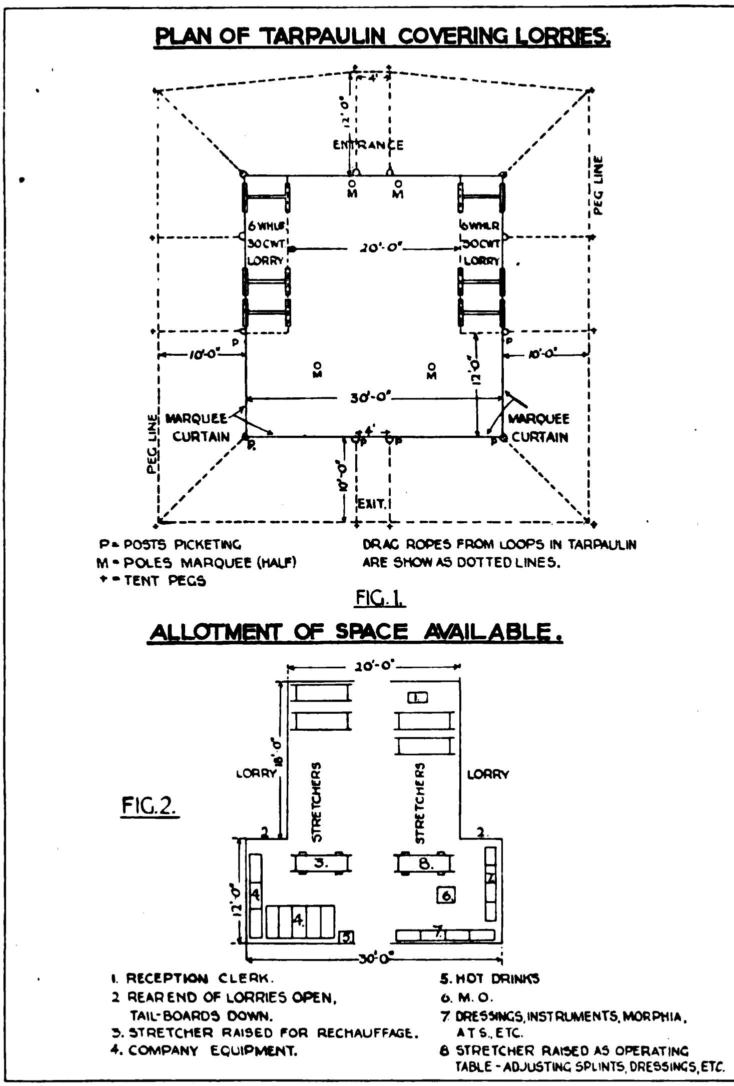
In the meantime the peg men had driven in large pegs in the correct positions shown in fig. 1, and the drag ropes were made fast.

At the rear end, six picketing posts were threaded through the tarpaulin loops to raise it, and again made fast by drag ropes. The two sections of marquee curtains were threaded round with tarred string commencing at the rear end of the lorry on each side and finishing in the centre at the exit.

Two half marquee poles supported the tarpaulin at the entrance and

two more, shown in the plan, kept the roof raised in the rear half of the enclosure.

The whole arrangement was then checked and squared up. This took six minutes.



Figs. 1 and 2.

Available Space.

The space available inside was surprisingly large and for training purposes was allotted as shown in fig. 2.

Near the entrance was the Reception Clerk, and between the lorries

two rows of ten stretchers could be placed with a four-feet gangway between.

Of the spaces in rear, one was used for the medical officer, or for dressings, adjustment of splints, anti-tetanus serum, morphia, etc., and the other for laying out equipment, issuing hot drinks and réchauffage. The lorries, of course, were now empty, and with their rear ends open and tail boards down, could be used for extra accommodation, special cases, medical officer, company office, as the case might be.

During manœuvre periods the shelter was equally successful for housing the men at night, and the entire company could be accommodated with ease.

Fig. 3—General arrangement. Reception Clerk on the left.

Fig. 4.—Entrance. Stretcher raised for adjustment of Thomas's Splint.

Fig. 5.—Rear view. Marquee curtains in position.

Summary.

Advantages.—Realistic; men became extremely keen and adept at construction and lay out. Speed of erection and dismantling. Small and compact; easily camouflaged. Ample accommodation for patients, medical officer and equipment. Night shelter for personnel. Equipment available for field ambulance stores. Useful practical field work for R.A.M.C.

Disadvantages.—Useless as an advanced dressing station in combined exercises, since it is unlikely that lorries will be allocated for company transport on future occasions. Impossible to make gas proof. Only useful for peace training, when field ambulance camp equipment has been drawn.

I am indebted to Colonel J. P. Lynch, A.D.M.S., East Anglian Area, for permission to forward this note for publication, and to Major J. M. MacKenzie, O.B.E., M.C., Officer Commanding Composite Field Ambulance, for allowing me to make experiments during the camp period and for his many helpful suggestions and criticisms.

ARE THE SEQUELÆ OF MALARIA CONTRACTED ON ACTIVE SERVICE STILL PREVALENT?[1]

By Professor Dr. P. MÜHLENS,

Tropical Institute, Hamburg.

During the last two years there has again been an increase in the number of expert diagnoses concerning alleged sequelæ of malaria contracted during the War and, in particular, concerning *deaths* due to a variety of diseases which the dependants have attributed to the *sequelæ of malaria contracted on active service* in order to establish their claim to a pension. I have been called upon to give an expert opinion on deaths due to cirrhosis of the liver, heart disease, peritonitis, tuberculosis and even pneumonia, all of which were attributed to malarial diseases dating from the War.

In many of these cases the relatives actually maintained that even up to the last stages, the patient had suffered at regular intervals (sometimes every two to four weeks) from typical attacks of fever. This statement is even now frequently made by ex-Service men who are sent to us for observation pending a decision on the award of a pension. Other patients state that, from time to time, they suffer from so-called "five day-fever" (trench fever).

In reports sent to us for expert opinion, it has been repeatedly stated that *malaria parasites* were still being found either by medical practitioners or in the laboratories of the hospitals fourteen to eighteen years after the actual primary infection. So far, however, we have never yet succeeded in seeing with our own eyes any specimen preparation in which positive parasites were present. To all our inquiries we have received the reply that, unfortunately, specimens had not been kept but that the parasites were undoubtedly of a malarial type. In the majority of cases they are said to be tertian parasites, but sometimes also subtertian parasites (even crescents) are reported.

In all the cases re-examined at our hospital for tropical diseases during the last six to eight years, we have never been able to *discover* even after provocation, etc., *one single parasite.* The other forms of disintegration of the blood-corpuscles characteristic of chronic malaria were also absent as well as all trace of enlargement of the spleen or liver, and other symptoms.

In one case, an ex-Service man had been drawing a pension for years on the grounds of enlargement of the spleen following malaria contracted on

[1] Communication received from Professor Mühlens, who will be glad to receive any information on the points mentioned in this paper. The solution of the problem is important in the interests of ex-service men and their dependents.

active service. We were able to diagnose that this inflammation of the spleen was really a cystic kidney and, after a successful operation, the patient's pension was withdrawn. In a great number of other cases different causes (for instance, pyelitis, T.B., etc.), were found for the alleged malarial fever or malarial sequelæ.

These few facts, together with previous experience in the treatment of malaria, will suffice to make it clear that the alleged cases of relapses due to malaria dating from the War, and malaria sequelæ, which have been reported up to the present time must be *regarded with the greatest scepticism and examined with the utmost care by malaria specialists.*

Obviously no ex-Service man should be caused, or allowed to suffer, any injustice. On the contrary, the new Germany is fully conscious of the individual services rendered during the struggle of the nations and is prepared to come to their aid in all cases when the injury to health can be attributed definitely, or even with approximate certainty, to the War.

For this purpose, however, it is necessary to *furnish* reliable *proof* that the injury occurred on active service or that there is an actual connection between the present illness and this injury.

All physicians, hospitals, pensions authorities, etc., can and should help in this work.

The Hamburg Tropical Institute is also prepared to devote itself entirely to the solution of these important questions and to assist physicians, hospitals and pensions authorities in clearing up doubtful cases.

I consider that the following conditions are absolutely essential to the attainment of this end :—

(1) In all cases when death is attributed to malaria contracted on active service, or to the sequelæ of malaria, a post-mortem examination should be made and the *organs—the spleen, liver, brain and bone-marrow, in particular—examined by specialists, for traces of malaria.*

(2) *In all alleged cases of relapse due to malaria contracted on active service, thick-drop and smear preparations must be examined by malaria specialists (before treatment is given), or sent to them for expert diagnosis Above all, presumably positive findings are to be carefully checked.*

(3) In the interests of *collective research* I beg my colleagues to send me *all* reports on the observation of relapses due to malaria contracted at the front, and, in particular, of any positive blood or organic conditions in malaria relapses, or in the sequelæ of malaria still existing, which have manifested themselves or been noted *more than six years after* the end of the War. Any available copies of expert opinions on this subject are also urgently needed.

(4) Finally, I should also like information as to where and when in Germany, during the post-War period, *autochthonous cases of malaria* (and of what type), or infections *connected with cases of malaria contracted at the front* or with *artificial infections in paralytics* have occurred and been definitely established.

"The observations which German doctors with experience in the tropics had collected before the War, concerning the course and sequelæ of malaria contracted in a foreign country as they appear in the climate of the German homeland tend to prove that, generally speaking, malaria is cured in Germany after a certain number of years, and also that the occurrence of relapses after an interval of five to six years must be considered as exceedingly rare."

These observations are not in any way contradicted but rather confirmed by the experience gained concerning the course and sequelæ of malaria contracted on active service. It is, therefore, of the greatest importance to insist that physicians advising ex-Service men who state that they contracted malaria during the War and maintain that they still suffer from malaria relapses, should only certify the presence of malaria : (*a*) After they have personally observed one or several attacks of fever ; (*b*) when, after making blood examinations during the attack of fever and sending the preparations to a research department specializing in the diagnosis of malaria, the examination has given positive results ; (*c*) when the probability of the fever being due to some other cause has been eliminated by a thorough clinical examination of the patient.

Until overwhelming counter-evidence is forthcoming it is impossible to disregard the views of our most experienced malaria specialists which moreover coincide with those of the malaria specialists of other nations.

I appeal to all *physicians at home and abroad* to collaborate in the final solution of this important scientific question, if only in the interests of the ex-Service men and their dependants.

This question is also equally important for our seamen since malaria and its possible sequelæ must be recognized as a possible "accident" in their calling. In this field also, all supposed cases of malaria or sequelæ of malaria must be immediately and thoroughly investigated, since it is to be feared that for many years or decades to come they will give rise to the same trouble with regard to diagnosis as has arisen in the case of malaria contracted on active service.

I should like to suggest that the Hamburger Tropeninstitut be chosen as the collecting centre for all post-War data. Address: Hamburg 4, Tropeninstitut.

Editorials.

THE HEALTH OF THE ARMY.

In the introductory letter to the Report on the Health of the Army at home and abroad for the year 1933, the Director-General points out that although the admission rate, the invaliding rate, and the constantly sick time during the year under review were higher than for the previous year, the general health of all ranks fell little short of the high level reached in 1932, the healthiest year since the Great War.

The increase in the admission rate is mainly accounted for by the prevalence of influenza at home and of malaria in India. There was an increase of the admission rate for influenza of 17·6 per 1,000 and for malaria of 6·2 per 1,000.

Chart I in the report shows at a glance the enormous improvement in the health of the Army that has taken place since 1921. For instance, in that year the admissions to hospital per 1,000 were 650, but in 1933 they were only 431, while the invalids discharged fell from 27·5 to 8·27.

The principal causes of admission to hospital during 1933 were influenza, malaria, inflammation of tonsils, inflammation of areolar tissue and venereal diseases, in the order mentioned.

There were 395 deaths, or 2·15 per 1,000 of strength, compared with 2·36 in 1932 and 2·41 for the period 1928-32.

The Commands with the highest ratio of inefficiency from sickness were Aden, Jamaica, China and Ceylon. Bermuda, Mauritius, Gibraltar and Malta had the lowest ratio.

Chart II shows the variations in invaliding from tubercle, syphilis, diseases of the nervous, digestive, and circulatory systems from 1899 to 1914 and from 1921 to 1933.

Following on the South African War there was a high peak of invaliding for circulatory diseases, reaching over 5 per 1,000 of strength, and a notable rise in nervous diseases, between 2 and 3 per 1,000. After the Great War there was again marked invaliding for these two diseases, but the nervous—more than 3·5 per 1,000—had a greater effect than the circulatory diseases. The influence of war on the total invaliding rate is well shown in Chart III. The peaks in 1901 and 1921 are very manifest.

At the present time invaliding for nervous and circulatory diseases is small, being less than 0·5 per 1,000 of strength. The principal causes of invaliding are pulmonary tuberculosis and inflammation of the middle ear.

The principal causes of inefficiency on account of sickness in hospital are: Gonorrhœa; inflammation of areolar tissue; fracture; malaria; influenza; and inflammation of tonsils.

The average sick time to each soldier was 8·04 days compared with 8·78 for the period 1928-32.

The daily average number of out-patients under treatment was 15·93 per 1,000.

The combined ratio of constantly sick in hospital and under treatment as out-patients was 37·95 per 1,000 of strength, compared with 36·86 in 1932, and 38·9 for the period 1928-32.

The two charts, IV and V, show at a glance the admissions to hospital and the principal causes of inefficiency. They again emphasize the importance of the common ailments. For instance, diseases of the digestive system, excepting tonsillitis, pharyngitis and diseases of the liver, caused at home a loss of 69,439 working days; while tonsillitis and diseases of areolar tissue were responsible for the loss of 32,123 days and 38,289 days respectively. Abroad, except India, venereal diseases caused the greatest loss in working days—76,773.

A new heading—common cold—appears in the list of diseases and will influence the statistics, especially of the out-patient departments. While many diseases now recorded as common cold would have found a place under one or other of the respiratory diseases, the actual admissions to hospital for common cold were only 488 or 2·7 per 1,000 of strength.

Sandfly fever is prevalent in India, Egypt, Palestine and Malta. The admission rates remain remarkably constant in these areas. In India the majority of the cases occur in certain stations on the North-West Frontier, and the disease has been the subject of special investigation during the year. The entomological aspect has been studied in Landi Kotal, and the exact local conditions for sandfly breeding having been defined no difficulty was then experienced in locating breeding places. Unfortunately, favourable conditions for breeding seem to be so widespread that the problem of control of phlebotomus fever under Indian conditions is considered to be practically insoluble. In compact areas like Landi Kotal something might be done; but in straggling cantonments like Peshawar the problem is thought to be a hopeless one. Work is, however, being carried on to determine the best methods of treating breeding places, so that this special knowledge may be applied in suitable circumstances. Approximately 90 per cent of the sandflies captured were *Phlebotomus papatasii*.

Certain observations carried out at Peshawar in 1932 suggested that the causal organism might be a leptospira, but by carrying out a large series of blood-cultures this theory has been definitely disproved. Experiments not yet complete leave little doubt that a filter-passing virus is responsible for the disease.

There were 1,522 cases of dysentery in 1932, compared with 1,494 in 1933; of these 1,369 occurred in India. Dysentery is practically confined to three commands, India, China and Egypt. There was a slight decline in the incidence of the disease in Egypt. In China there was a slight increase. The ratios of admissions per 1,000 of strength in the three commands were: India 24·9; China 8·3; and Egypt 4·1.

Analysis of the 1,494 cases showed that there were 961 admissions for bacillary dysentery, 216 for amœbic dysentery, and 347 were unclassified.

In India some 15 to 20 types of dysentery bacilli, of which 10 are

common, have been differentiated. An analysis, however, of cases occurring in any one unit in one season shows that great diversity exists and few of the cases are ætiologically related to one another. From this it would appear that infection in a unit does not spread from case to case, but is acquired from the civil population outside the regimental area.

A scheme of classification of mannite-fermenting dysentery bacilli was introduced in India in June, 1932, and has proved satisfactory. The term "inagglutinable Flexner" has disappeared from the statistics. In 1933, out of non-mannite-fermenting bacilli isolated in the military laboratories 253 were Shiga and 80 Schmidt; of 1,564 mannite-fermenting bacilli isolated 960 were Andrewes' type; 198 Sonne; 315 new types; and 91 unclassified. The percentage of unclassified bacilli has been reduced from 36·9 in 1928 to 5·8 in 1933. Of the 91 unclassified strains, 46 were late lactose-saccharose fermenters and are considered to be non-pathogenic. Among the new types, three are of common occurrence: one is a dulcite fermenter and serologically identical with the "Newcastle" bacillus; another corresponds to the original *Bacillus dysenteriæ* (Lentz); the third has not hitherto been described.

There are five other types relatively common: one is described in the series reviewed by Sartorius, the other four, all dulcite fermenters, do not appear to have been described. All these types are believed to be pathogenic.

In 1933 malaria caused an increase of 1,200 cases over the figures for 1932. India accounted for more than 1,000 of the cases. This increase was mainly due to the large number of infections arising in the Northern and Western Commands, India, where abnormal meteorological conditions, and to a less extent active service operations, were held responsible.

In India the monsoon rainfall in the June to September period was much above the normal, except in the north-east and in Burma. This partly explains the increased incidence in the Northern and Western Commands, and the decreased incidence in the Eastern Command and Burma. But that rainfall alone is not the complete explanation is evidenced by the fact that in the worst malaria year, 1924, the percentage departure from the normal was +8, while in 1933 the percentage departure from the normal was +14.

October, when the monsoon recedes, presents great variations from year to year, and when the rainfall is excessive a marked effect is produced on the incidence of malaria. In the worst year, 1924, the all-India departure from the normal during October was +3, in 1933 the departure was +6.

It is therefore surprising that the 1933 figures were so much better than those for 1924. The incidence of malaria in 1924 was 206·8 per 1,000; in 1933 it was 103·3, and in 1932, 84·1.

Mosquito-proofing of barracks has diminished the incidence of malaria. In Mian Mir the average annual malaria incidence for the five years, 1923-27 was 743; proofing was carried out in 1927-30, and the average

annual incidence, 1923 to 1933, fell to 124·4. Unfortunately, owing to financial stringency, it was decided in 1931 to abandon proofing until the situation improves.

Cold storage, which aimed at the removal of the bulk of the troops to the hills during the malaria season, has not achieved all that was expected. It has been found impossible to carry out the scheme in its entirety owing to exigences of military training and shortage of barrack accommodation in the hills. Half of the infantry are in the plains in the dangerous months, and cavalry and artillery only stay in the hills about one and a half months.

In 1933, however, there were two important factors in favour of a good year in respect of malaria. In 1932 the malaria incidence for British troops was unusually light, and the "carry over" of infection to the following year was comparatively small, so the possible foci were much smaller in 1933. In 1933 the administration of plasmoquine was standardized and the drug was in general use. In 1932 it was thought that the more extensive and intelligent use of plasmoquine was mainly responsible for the record low figures of that year. It is believed that had it not been for the standardized general use of plasmoquine the 1933 figures would have been much worse. It has been shown that quinine-plasmoquine and also atebrin-plasmoquine can effect a remarkable reduction in malaria relapse rates.

Fevers of the typhus group show an increase in India; in 1933 forty-four cases were diagnosed; the increase is believed to be due to a more widespread knowledge of the subject. Agglutination tests have been carried out with the serum of a considerable number of cases, employing "O" suspensions of *B. proteus* X2, X19, and X Kingsbury; but the variations from case to case have been so great that it is believed that none of these is the specific strain of proteus involved. Attempts to isolate *B. proteus* from these cases have failed.

The use of "O" suspensions of the *B. proteus* strains for agglutination purposes has, however, permitted a number of cases to be diagnosed, which typical in other ways had no characteristic rash, but did show a suggestive rise in the titre of the agglutination. In other circumstances these cases would have been labelled "enteric group of fevers" or P.U.O.

No definite progress has been made as regards the detection of the vector in India.

There has been very little variation in the number of cases of enteric fever in India during the past three years. Most of the cases have been sporadic in origin. There was an outbreak of sixteen cases in a company of infantry at Mazuffarpur and the type of case was very severe, resembling that seen in pre-inoculation days. All the men had been inoculated with two doses of T.A.B. vaccine within a period of eighteen months.

The enteric group of fevers for the Army as a whole shows a continued

decline from an average of 1·3 admissions per 1,000 of strength for the last five years to 1·1 for 1933.

During 1933 there was a large increase in the number of admissions for influenza: 7,447, compared with 4,161 in 1932. Most of the cases occurred in the United Kingdom. The Western, Eastern and Aldershot Commands had the highest ratio of admissions per 1,000; the Scottish and Northern Commands had the lowest ratios. There were 1,444 cases in India, and 316 cases were reported from China. Inoculation was carried out in certain commands, but was considered to be of no value.

There has been a steady decrease in the incidence of venereal diseases, and Chart VI shows the reduction which has taken place in recent years. The incidence in China is still very high, though there has been a slight improvement during the year. The figures for Jamaica show a considerable increase, but at this station, as in China, the disease is very difficult to control.

In 1933 the incidence of gonorrhœa was 17·2 and that of syphilis 3·3, compared with 22·9 and 5 for the period 1928-32.

The Royal College of Physicians having classified neurasthenia and hysteria as mental diseases, 258 cases of the former diseases have been transferred to the mental group, with an apparent large reduction in the figures for nervous diseases and a corresponding increase for mental diseases. Compared with 1932, there has really been a slight decrease in the admissions for nervous diseases, and a small increase in those for mental diseases.

In the report from the Special Department of Medicine, attention is drawn to the effects of the special treatments for malaria that are now in use. A comparison of the ratios between fresh infections and relapses for India shows that the sterilization treatments are beginning to take effect. For the period 1924-31 the ratio of primary to relapse cases was 1 : 1; for 1932 it fell to 1 : 0·71, and for 1933 to 1 : 0·3.

The subject of cardiac disease in soldiers and recruits is receiving special attention, and arrangements are being made to organize a special cardiac centre, at which the most modern equipment for diagnosis will be available.

Cysticercosis as a cause of epilepsy continues to be investigated, and receives support from the steady increase in the number of cases proved to be positive.

The scope of the surgical work in the Army is indicated by the number of operations, covering most branches of surgery, which have been performed. In 31 hospitals at home 7,075 operations were performed; in India the number was 4,868.

The mortality following operations for such special conditions as appendicitis, perforated gastric ulcer, duodenal ulcer, and diseases of the gall-bladder compares favourably with that following similar operations

performed by specialist surgeons in civil institutions. It should be noted that a considerable proportion of these operations in the Army were performed on elderly officers and old pensioners.

Special attention has been given to basal hypnotics for premedication as an aid to general anæsthesia. The general opinion as regards nembutal is unfavourable.

There is considerable divergence of opinion as regards evipan sodium; more experience with it is required before it can be taken into general use. Very satisfactory results have been obtained with avertin at the Queen Alexandra Military Hospital, Millbank.

In the report from the Hygiene Department there are some interesting notes on water sterilization in the field; experiments carried out in Egypt have shown that with the standard dose of ammonia and chlorosene most waters obtainable in Egypt can be rendered safe for drinking in one hour provided preliminary clarification is carried out. It has also been found that the cercariæ of human schistosomiasis are killed by treatment for one hour with two tablets of ammonia and two scoops of chlorosene.

Investigations have been carried out in the Hygiene Department of the Royal Army Medical College on the chemical and bacteriological properties of chloramines. Experiments have shown that the bactericidal action decreases *pari passu* with a rise in the proportion of ammonia, and the best ratio of chlorine to ammonia is 4 : 1. It is stated that "filtration prior to chlorination is essential, as without it chloramine does not penetrate into particulate matter sufficiently rapidly to effect sterilization in the cistern." "So long as chloramine is prepared correctly, doses not exceeding two parts per million are tasteless."

In the Pathology Department, Royal Army Medical College, research on the modification of the present typhoid-paratyphoid vaccine, commenced in 1932, has been continued. Further experience of the assessment of the protective power of a typhoid vaccine by means of mouse-protection tests has shown that the strain of typhoid organism employed for many years has deteriorated in protective power. In the early part of the year a more recently isolated strain of this organism was substituted for the original culture. When the regulations dealing with the care of the inoculated individual are properly observed there are no undue reactions.

Further investigation has demonstrated that the virulence, and its corollary the protective power, of the original strain of typhoid bacillus can be enhanced by certain methods of animal passage and subsequent laboratory experience seems to indicate that the protective value of this rejuvenated strain is equal to, if not greater than, that of the strain recently included in the vaccine.

The paratyphoid components of the vaccine have remained unchanged, and a similar method of increasing their protective power may be desirable. These investigations are in progress.

THE ONE PIPE SYSTEM OF HOUSE DRAINAGE.

So few changes have taken place in England within living memory in the essentials of the methods of dealing with household wastes, and in the apparatus used for this purpose, that many have come to look upon these methods as being so satisfactory as to be unlikely ever to alter.

To those in this state of mind the knowledge that our routine methods and apparatus have in the last few years been the subject of much adverse criticism, ending in the virtual recognition of an alternative system—the so-called "one pipe system"—for the collection and removal of fluid wastes from our houses, has come somewhat as a surprise.

Since the appearance of the "Model Bye-laws" issued by the Local Government Board under the authority of the Public Health Act of 1875 it has been a cardinal principle of the sanitation of dwellings in England that no drain inlet should be permitted inside a house except the inlet necessary for a water closet and that the waste pipes of sinks, baths and lavatories and every pipe for conveying waste water must be taken through an external wall and discharge in the open air on to a channel leading to a trapped gully at least eighteen inches distant. The same bye-laws state that a water closet, if inside a house, must adjoin an external wall and that every soil pipe must be placed outside the building.

That the necessity for this absolute separation of what were considered to be two distinct classes of waste liquids in their passage to the house drain and sewer was founded on entirely wrong premises has been realized by increasing numbers of those engaged in public health work but the faith in the malign influences so long attributed to sewer gases plus their supposed ability to convey into houses the infective agents of typhoid fever, diphtheria and other diseases has continued to colour the mental processes of many others in spite of the growing mass of evidence disproving these assumptions.

In fact nothing that we have learned from modern bacteriology regarding the viability and methods of spread of the organisms of disease can be made to support the theories that led to the introduction of the separate system.

In addition, it has been common knowledge that the separate system was in practice only used in this country as can be readily verified by perusal of foreign text books of hygiene, and apparently no marked ill-effects resulted from the methods adopted in other countries.

The critics of the English, or separate system have pointed out that the fluids coming from bath wastes and similar pipes are often very foul and that as a result the open gully traps into which such wastes discharge, instead of being a protection against gases coming up from the drain, often themselves become receptacles for putrefying organic matter and a source of nuisance. They also point out that with the separate system there are at least four or sometimes five pipes or sets of pipes appearing on the walls

of the ordinary house, namely soil pipe, anti-syphon pipe, waste pipe, vent pipe and rain-water pipes, and that, in large modern buildings such as blocks of flats or hotels, with ablution basins, baths and water closets for each apartment or suite, this leads to the erection of such a forest of pipes as to appear ludicrous and to add considerably to the cost of such buildings. They further state that, provided efficient traps are placed under basins, baths and similar appliances and if the plumbing is skilfully carried out, there is no reason why all waste fluids should not reach the drain via the soil pipe and that, further, there is no reason why the soil pipe should not be erected inside the building. Such an arrangement reduces the cost by doing away with superfluous waste pipes and reducing the number of branch drains, while placing the soil pipes inside buildings allows architects greater freedom in the siting of bathrooms and water closets and gives them more satisfactory opportunities for effective treatment of the buildings from the artistic point of view.

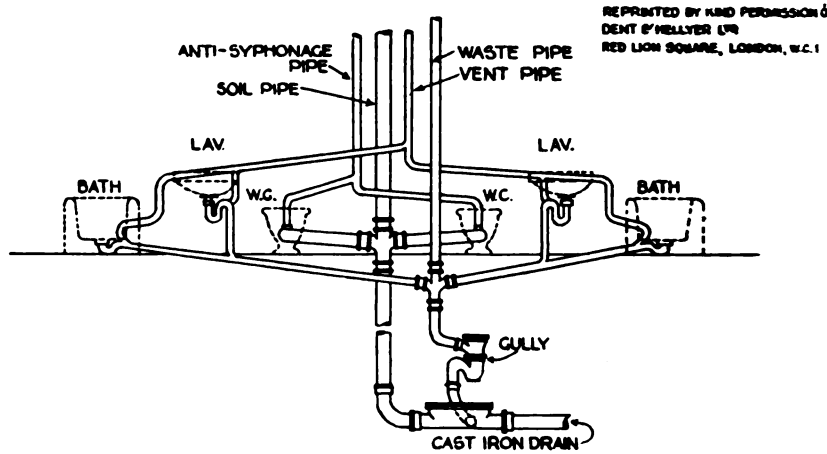
One gentleman, in a recent discussion on the subject, drew attention to the fact that the human being does not wear his intestines on the outside and that there appeared no good reason why analogous structures in our residences should be exposed to the public gaze.

The replies to such criticisms took the form that the traps under the bath and wash basins would readily become unsealed by aspiration, siphonage or evaporation, that where this did not happen there would be diffusion of gases from the drain through the water seals and that the soil pipes would become a source of danger and would in addition probably require to be bigger than the ordinary four-inch soil pipe now in general use. The obvious method of dealing with such fears was to point out that in the United States and in Canada, where the one pipe system is the only one in use, troubles from the unsealing of traps or the diffusion of gases did not appear to occur frequently enough to cause any alarm, that the capacity of the ordinary soil pipe was much greater than most people imagine and that those of the size in general use could safely deal with much larger quantities than were likely to be discharged into them, pipes of that size being stated to be capable of dealing with the discharge from forty-eight sets of sanitary fittings, each set consisting of a water closet, bath, lavatory basin and a sink, while in addition the continual flushing with waste water would wash away any deposits of fæcal matter from the insides of the pipes. As a result of these discussions and of the risks taken by certain pioneers in departing from the accepted methods when they saw good reason to do so the London County Council has, with the approval of the Ministry of Health, amended the bye-laws to permit of the adoption of the one pipe system, and it has been installed in the Cumberland Hotel in Marylebone.

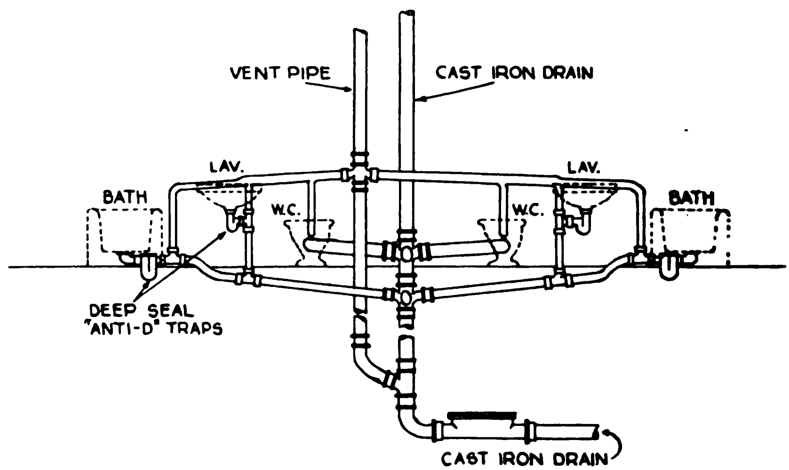
In the system as installed in this hotel the soil pipes, accompanied by ventilating pipes, are placed inside the buildings in spaces provided between each pair of rooms or suites. These pipes run in the shafts so formed from

ground level to terminate in the open air above roof level, the ventilating pipe being connected with the soil pipe below the lowest sanitary fitting.

In planning the building care has been taken to group the sanitary



A GROUP OF SANITARY APPLIANCES DRAINED BY THE SEPARATE SYSTEM.



THE ONE PIPE SYSTEM APPLIED TO THE SAME GROUP OF APPLIANCES. NOTE THE SIMPLIFICATION OF THE ENTIRE SCHEME, DUE TO ELIMINATION OF THE SEPARATE WASTE STACK AND ITS ATTENDANT VENTILATING PIPES.

fittings in proximity to the shafts containing the soil pipes so that the lengths of the discharge pipes connecting such fittings with the soil pipes will be limited.

The discharge pipe from each fitting, water closet, bath, basin or sink is equipped with a satisfactory trap with a deep water seal of $2\frac{1}{2}$ inches to 3 inches, i.e. of greater depth than the 2-inch seal now in general use, siphonage of these traps being guarded against by the junction of a branch from the ventilating pipe with the discharge pipe on the distal side of each trap.

The soil pipes are made of cast iron while the discharge pipes from baths, basins, etc, are of copper.

With these fittings the whole of the liquid wastes from inside the house are transferred to the drain via the soil pipe and the only outside gullies connecting with the drainage system are those for the collection of rain water. The advantages gained by the reduction in the number of pipes used are shown in the accompanying diagrams.

It is improbable that the adoption of the one pipe system will lead to such extensive benefits in the case of military buildings of the present type as it has done in the case of this large hotel; but in hospitals, in blocks of married quarters of the verandah type, in mess buildings and, perhaps, in modern types of barrack buildings there are possibilities of simplifying the house drainage system so that it will be cheaper to construct, be more automatic in action and will not require the frequent cleaning of foul gully traps which now devolves on the troops.

Disconnecting or intercepting traps. Associated with the discussions on the one pipe system another part of the house drainage system has also, not for the first time, come under adverse criticism, i.e., the disconnecting chamber and trap which now in theory divides the sewer from the house drain.

As at present arranged this chamber forms a junction for branch drains with the main channel, is equipped with an air inlet to provide for ventilation of the whole of the house system to the top of the soil pipe and is also fitted at the outlet of the drain from the chamber with a trap which, while allowing a free flow of matters passing down to the sewer, is intended to prevent any dangerous sewer gas from entering the house drain.

The critics state that any trap in this situation acts as an obstacle to the free flow of sewage, must become a receptacle for decaying organic matter and is likely in itself to become a nuisance.

In addition they point out that the interposition of a trap to keep sewer gas out of the house drain is entirely unnecessary; in the first place because the sewer gas is harmless and secondly because if there were no disconnecting traps and every soil pipe became a ventilating shaft for the sewer, there would be no obstacle to the free circulation of air throughout the whole system and no difficulty in maintaining its purity.

So far these discussions have led to no definite results but the general opinion would appear to be that where house drains and sewers are well made, of good gradient and free from deposit, there seems to be little to be gained by the retention of the intercepting trap.

Clinical and other Notes.

A CASE OF CEREBROSPINAL MENINGITIS: ILLUSTRATING CERTAIN OF THE PRINCIPLES OF TREATMENT OF THE DISEASE.

By Major W. M. CAMERON, O.B.E.,
Royal Army Medical Corps.

Private S., Depot, King's Own Yorkshire Light Infantry, reported sick on August 7, 1933, with headache and sore throat. He also complained of stiffness of the neck. He became worse on August 8 and vomited several times, and on the 9th he was unable to walk and was admitted to hospital.

On admission he presented typical symptoms of cerebrospinal meningitis. Kernig's sign was present. There was a mild degree of head retraction, and the reaction of the pupils to light was sluggish; the fundi were normal. The deep reflexes, ankle and knee jerks, could not be elicited. The temperature was only 99° F., pulse 74. He was drowsy and apathetic mentally. Total white blood-corpuscle count was 20,000. Lumbar puncture revealed a turbid cerebrospinal fluid under moderately increased pressure. Numerous meningococci were seen in the direct smear. The cell count in the cerebrospinal fluid was 8,000 with 90 per cent polymorphs. Meningococci were also isolated from a nasopharyngeal swab.

Treatment was then commenced with the standard type I and III antimeningococcus serum, thus:—

August 9: 35 cubic centimetres of cerebrospinal fluid withdrawn; 20 cubic centimetres serum given intrathecally.

August 10: 25 cubic centimetres of cerebrospinal fluid withdrawn; 18 cubic centimetres serum given intrathecally.

August 11: 25 cubic centimetres of cerebrospinal fluid withdrawn; 18 cubic centimetres serum given intrathecally.

On August 11 (evening) his temperature rose to 101·8° F., and his condition became much worse; head retraction was now marked, vomiting was severe, and mentally he was bordering on coma. On August 12 his condition was so bad that, continuing the use of Nos. I and III type serum, two lumbar punctures were performed. 40 cubic centimetres of cerebrospinal fluid were withdrawn and 20 cubic centimetres of serum injected on each occasion. On the 11th, the meningococcus had definitely been typed as type IV. It was agglutinated by type IV serum and by the patient's serum. A polyvalent serum was obtained, and on the 13th a combined cisternal and lumbar puncture was performed. The method was as follows:—

Under a general anæsthetic a lumbar puncture was first performed and the cerebrospinal fluid drained till the pressure appeared normal. A cisternal puncture was then performed and the polyvalent serum was run in through the cisternal needle by means of a rubber tube attached to the needle and distally to a glass funnel. On this occasion 35 cubic centimetres of cerebrospinal fluid were withdrawn at the lumbar needle ; then 35 cubic centimetres of serum were run in at the cisterna and the same amount of cerebrospinal fluid allowed to drain from the lumbar needle. The cerebrospinal fluid from the lumbar needle, which was at first very turbid, was now almost clear, showing that the cerebrospinal fluid had been practically replaced by serum in the theca.

On the morning of August 13 the patient had been completely comatose with a temperature of 103° F., and the prognosis looked very grave, but after the above procedure he made good progress. He was merely drowsy mentally and ceased vomiting. The treatment was continued as follows :—

August 14: 40 cubic centimetres of cerebrospinal fluid withdrawn ; 18 cubic centimetres of serum given intrathecally.

August 15: 40 cubic centimetres of cerebrospinal fluid withdrawn ; 18 cubic centimetres of serum given intrathecally.

August 16: 40 cubic centimetres of cerebrospinal fluid withdrawn: 17 cubic centimetres of serum given intrathecally.

During the above period he made great improvement and his temperature reached normal for the first time since August 12. The cell count on the 15th had been 1,008, but on the 17th the count was found to have risen to 2,400, and this was coincident with a clinical relapse. His temperature rose to 101·6° F. and he again became delirious with marked head retraction. The following treatment was given :—

August 17: 50 cubic centimetres of cerebrospinal fluid withdrawn ; 18 cubic centimetres of serum given intrathecally.

August 18: 40 cubic centimetres of cerebrospinal fluid withdrawn ; 20 cubic centimetres of serum given intrathecally.

August 19: 35 cubic centimetres of cerebrospinal fluid withdrawn ; 18 cubic centimetres of serum given intrathecally.

In spite of this treatment the cell count on the 19th was 2,140 per cubic centimetre, and the fluid was definitely purulent. The patient's general condition was poor, his temperature 102° F. and the mental condition one of coma.

On August 20, a second cisternal puncture combined with a lumbar puncture was performed under general anæsthesia. On this occasion, however, after 40 cubic centimetres had been withdrawn from the lumbar site, 240 cubic centimetres of saline were run in through the cisternal needle by the same method as detailed above, the funnel being held about

12 inches above the head. About the middle of this operation it was evident from the character of the fluid emerging from the lumbar needle that the theca had been completely irrigated. When 240 cubic centimetres had been recovered, the lumbar needle was withdrawn and 20 cubic centimetres of polyvalent serum were injected by the cisternal route.

The improvement after this procedure was nothing short of remarkable. The temperature fell to 98° F., and the cell count of the cerebrospinal fluid on August 21 was 810 cells per cubic centimetre. Treatment was continued as follows:—

August 21 : 38 cubic centimetres of cerebrospinal fluid withdrawn; cell count 812.

August 22 : 40 cubic centimetres of cerebrospinal fluid withdrawn; cell count 533.

August 23 : 30 cubic centimetres of cerebrospinal fluid withdrawn; cell count 227.

August 24 : 35 cubic centimetres of cerebrospinal fluid withdrawn : cell count 108.

August 25 : 35 cubic centimetres of cerebrospinal fluid withdrawn ; cell count not done.

As the condition was now much improved, no fluid was withdrawn on August 26 and 27. The mental condition was now excellent. He was practically afebrile; temperature 99° F. On the 24th and 25th it was noticed that the cerebrospinal fluid was orange in colour, and that the lumbar puncture caused intense pain. In fact, on the 25th he required an injection of morphine after the puncture. On the 28th a lumbar puncture was again performed and again a straw-coloured cerebrospinal fluid (20 cubic centimetres) was withdrawn and 15 cubic centimetres polyvalent serum were injected. This was followed by what appeared to be a definite relapse. On August 29 the temperature rose to 102° F. A lumbar puncture was performed and 60 cubic centimetres of rather turbid orange-coloured cerebrospinal fluid were withdrawn. Cell count in this fluid was 1,510 per cubic centimetre, an increase of 1,400 from the count on the 24th. Unfortunately, no differential count of these cells was carried out, as the importance of this was not realized at the time. On August 30th, under the impression that a real relapse had recurred, another combined cisternal and lumbar puncture was carried out thus:—

50 cubic centimetres of cerebrospinal fluid were withdrawn; 20 cubic centimetres of serum injected, and 240 cubic centimetres normal saline were again used to irrigate the theca.

The patient again improved. I imagine in this case the improvement was due solely to the irrigation and reduction of intrathecal pressure, though on this occasion it was noted that the pressure was not noticeably high. It was particularly easy to estimate when the saline had reached the lumbar region, as the cerebrospinal fluid was orange-coloured and the

irrigation was continued till the fluid issuing from the lumbar needle was quite colourless.

Treatment was continued as follows:—

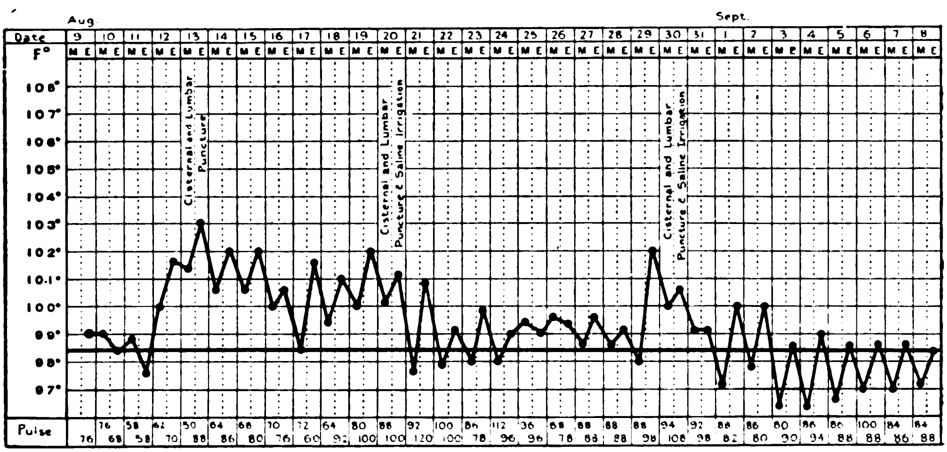
August 31: 30 cubic centimetres of cerebrospinal fluid withdrawn; cell count 2,500.

September 1: 50 cubic centimetres of cerebrospinal fluid withdrawn; cell count 1,672.

September 2: 30 cubic centimetres of cerebrospinal fluid withdrawn; cell count not done.

September 4: 15 cubic centimetres of cerebrospinal fluid withdrawn; cell count 1,200.

September 6: 20 cubic centimetres of cerebrospinal fluid withdrawn; cell count 238.



September 8: 20 cubic centimetres of cerebrospinal fluid withdrawn; cell count not done.

September 9: 20 cubic centimetres of cerebrospinal fluid withdrawn; cell count not done,

September 11: 20 cubic centimetres of cerebrospinal fluid withdrawn; cell count 83.

September 19: 15 cubic centimetres of cerebrospinal fluid withdrawn; cell count 58.

He received no further serum except one injection of 20 cubic centi metres on September 1.

During this period he became convalescent. The cerebrospinal fluid was clear on September 6, and he became afebrile on the same date. He made an uninterrupted recovery, a transient diplopia of a few days' duration being the only sequela. He was discharged to sick leave on November 14, 1933, and returned to full duty at its conclusion.

The following is a précis of his treatment :—

Twenty-nine lumbar punctures were performed.

1,005 cubic centimetres of cerebrospinal fluid were withdrawn in 29 punctures; average 34·6 cubic centimetres.

295 cubic centimetres of serum in 15 injections were given intrathecally; average 20 cubic centimetres.

Three cisternal punctures were carried out; each was combined with a lumbar puncture and drainage. In the last two punctures saline irrigation with normal saline (240 cubic centimetres) through the theca was carried out prior to the injection of serum by the cisternal needle.

The outline of the treatment of this case has been given in detail because it illustrates very clearly most of the important points regarding the treatment of this disease. One does not need to stress the point now so well known that early treatment is an essential of success. The case, however, clearly demonstrates :—

(i) That the specific serum is necessary. This case, a type IV infection did not improve in any way under treatment with the standard types I and III serum. It is therefore necessary to type the meningococcus at once and ensure that the correct serum is being used.

(ii) That in all cases of cerebrospinal meningitis of a severe character which do not immediately react to treatment by intraspinal injections of serum by the lumbar route, cisternal puncture should be carried out and the serum injected by this route. Cisternal puncture is a comparatively easy procedure. Full details of the technique are given in many textbooks, and there is an admirable article in a recent number of the *Practitioner* [1] on the subject. All the literature on the comparative efficacy of serum given by the lumbar and cisternal routes shows that there is a definite advantage in the latter route. I. Goldman and A. G. Brown [2] in fifty cases report a difference of 22 per cent in favour of the cisternal route. It is quite obvious that by this method the therapeutic agent is being brought into closer contact with the infected site. I think that the advantages of the cisternal route are not sufficiently realized and that this method is not sufficiently used. This case would, in my opinion, undoubtedly have had a fatal termination if it had not been employed.

(iii) That saline irrigation of the theca is also a procedure of value. The second cisternal puncture with the saline irrigation effected a much more dramatic improvement than the first when no irrigation took place, and I consider that it was the saline irrigation and not the serum that effected the improvement on the third occasion, as I will explain later.

Whittingham, Kilpatrick and Griffiths [3] state that the aim of treatment should be to replace the purulent cerebrospinal fluid by a bland fluid, to reduce the intrathecal pressure to normal and to ensure a uniform distribution of the serum throughout the subarachnoid space. They irrigated with 100 to 200 cubic centimetres of normal saline and injected 30 cubic centimetres of serum. The normal cerebrospinal fluid contains 0·75 to 0·73 sodium

chloride and the amount is 100 to 150 cubic centimetres. I was not aware of the above work and used a somewhat unnecessarily large amount of saline for irrigation. It is of course essential to measure carefully the total amount of saline and serum injected and the total amount of fluid withdrawn by the lumbar needle. The latter amount should be from 20 to 30 cubic centimetres greater than the former.

This case also illustrates clearly the results and the dangers of a rather unappreciated error of treatment—that of over-treatment, and as a corollary illustrates the fact that treatment must be controlled.

The only literature on cerebrospinal meningitis in which I have seen the dangers of over-treatment pointed out and discussed is a Ministry of Health Memorandum No. 124, being a report presented to the Office International D'Hygiene Publique in May, 1933, by Dr. J. Cantacuzene on results obtained in Rumania by antimeningococcal serotherapy. This memorandum advises that treatment be continued by intrathecal injections of serum every three to ten days, as long as free meningococci are present, and "as long as there is no lymphocytosis in the cerebrospinal fluid, and as long as the neutrophile leucocytes preserve their pyocytic character." It should be stopped as soon as the cells in the cerebrospinal fluid change from polymorphonuclears to lymphocytes, otherwise there is a danger of producing a serous meningitis which may prove fatal. When a condition of local allergy is developing, the following changes occur in the cerebrospinal fluid: (i) The fluid becomes straw or orange-coloured; (ii) the fluid becomes rich in albumins and is coagulable by heat; (iii) meningococci are not seen; (iv) the polymorphonuclears become normal in appearance and diminished in numbers, and the lymphocytes and monocytes become more numerous.

Clinically the intrathecal injection also causes great pain, especially as the first few drops enter the canal, and there is a rise in the temperature of the patient.

The above case illustrated these points clearly after the combined cisternal and lumbar punctures with saline irrigation on August 20. No further serum was given for some days. On August 25, it was noticed that the cerebrospinal fluid was straw-coloured and the pain on lumbar puncture was intense. Morphia was in fact required as an accompaniment of the injections. On August 28, in addition to withdrawing 20 cubic centimetres of cerebrospinal fluid, 18 cubic centimetres of serum were injected. This was the first injection since the procedure on August 20. On the 29th, the temperature which had been 99° F rose to 102° F, and he developed what appeared to be a severe relapse of the original condition. The cell count in the cerebrospinal fluid was 1,510 compared with 108 on the 24th. Unfortunately a differential count was not done. If it had, I imagine it would have been discovered that these cells were largely lymphocytes. On the 30th, as noted above, another irrigation, followed by an injection of 20 cubic centimetres serum, was carried out, and though this was

followed by improvement, I attribute this solely to the saline irrigation and the relief of pressure. It is interesting to speculate what would have been the ultimate result if the irrigation had not been carried out and the serum injections had been continued.

Summary.

To recapitulate the important points illustrated in the treatment of this case:—

(i) *Specific* serum is necessary. The meningococcus must be typed at once and a serum embodying that type used. There was an absence of any therapeutic result in this a type IV infection with types I and III serum.

(ii) The serum must be brought as closely as possible into contact with the infected site. This implies the routine use of cisternal puncture with injection of serum by this route, and in young children intraventricular injection through the fontanelles.

(iii) In severe cases saline irrigation with 150 to 200 cubic centimetres normal saline is a valuable adjunct to serotherapy.

(iv) Treatment must be controlled by daily examination of the cerebrospinal fluid which must include a *differential* cell count, and treatment by serum must be discontinued on the occurrence of any of the precursors of serous meningitis noted above and on a definite change to a non-granular type of cell in the cerebrospinal fluid.

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[1] *Practitioner*, November, 1934.

[2] *American Journal of Medical Science*, 1930, Chapter CLXXXI, 414.

[3] *British Medical Journal*, 1931, i, 1101.

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A RARE COMPLICATION OF TYPHOID FEVER—PYONEPHROSIS.

By Captain JAMES WRIGHT,

Royal Army Medical Corps (T.A.)

Some time ago a boy aged 11 years, came under my charge suffering from typhoid fever. He was acutely ill; no rash was visible, the spleen was not enlarged and no typhoid organisms were isolated from the fæces or urine. The Widal was positive (1 : 60).

A week afterwards a small, rounded, tender swelling was found on the left side of the abdomen about an inch below the costal margin and extending to within an inch of the middle line. The tumour did not descend on respiration ; it felt very tense and the percussion note was dull. The liver

was not enlarged and there was nothing abnormal in the chest. Another specimen of urine was examined and *Bacillus typhosus* was isolated from it.

From day to day this swelling perceptibly increased in size, extending from the left costal margin to about two inches from the left iliac crest. Fluctuation was made out and the dullness found on percussion could not be separated from the splenic dullness. After exploring this swelling posteriorly with a needle and finding pus, the usual lumbar incision was made and a large quantity of pus evacuated from which *B. typhosus* was isolated. The abdominal tumour disappeared and no urinary sinus followed. Unfortunately the child died a fortnight later. At the post-mortem examination the left kidney showed a marked condition of pyonephrosis.

According to the history of the patient procured from the family doctor there never had been any previous renal trouble, and there were no renal symptoms during the course of the typhoid fever.

In the literature of typhoid fever I believe that this complication has only been mentioned two or three times.

A number of years ago Greaves reported a case which had had typhoid fever, and some years afterwards he incised the kidney by the lumbar route and found a stone and pus from which *B. typhosus* was isolated.

An interesting case of a man who was a urinary typhoid carrier is described by Armstrong. This man had had typhoid fever some years before and eventually a left nephrectomy was done. The kidney showed a marked degree of hydronephrosis, and the contents of the pelvis consisted of a thin turbid fluid containing leucocytes and a pure culture of typhoid bacilli.

According to Withington bacteriuria often occurs in typhoid fever without pyuria or other evidence of inflammation. The bacteria are simply being excreted and they may at times take on active growth, evinced by the products of pus and often accompanied by pain. On the other hand, Neufeld holds that typhoid bacilli establish themselves in the kidneys, and there form little metastatic foci before they pass to the urine.

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AN IMPRESSION OF G.P.I.

By Captain J. H. TAYLOR,
Royal Army Medical Corps (T.A.).

In a multitude of things the general view of the many is not at all flattering to the research work of the few, and I have had this impressed upon me very thoroughly so far as the treatment of general paralytics is concerned. Recently I held an appointment in a Mental Institute as a senior student and became vastly interested in the treatment of G.P.I. In systematic classes I had come to believe that treatment was carried out in these cases but that, generally speaking, it was hopeless. Now that I have seen the practical application of the treatment, I am far from agreeing with the futility of treating these cases. Let me add now that I do not, for one moment, believe that any treatment is curative in so far as recovery of loss of nerve function is concerned, but I do maintain that appropriate treatment will cure the activity of the spirochæte, clear up mental disturbance to a great extent and make a useless mass of humanity into a useful machine again. Of course, there is always some mental deficiency, and in a few very advanced cases the syphilis is cured, but there has been so much cortical degeneration that mentality is too far impaired to permit of that person being housed in any other place but a mental hospital.

Then again, the general belief is that the 5 per cent of syphilitics developing mental symptoms is confined to those people who are dependent on their mental powers for their daily bread. In my very puny experience I have found no ground for this belief. Certainly I have come in contact with a mere thirty cases, but of these only one held a position in the industrial world where it could be said that his occupation called upon his brain more than on his physical powers, and he was a shipping clerk. There were ships' stewards, picture-house attendants, labourers, carters and so forth, but none of these could be said to be in a position where his mental powers were taxed, nor could I elicit a constant history of strain through worry, etc. Most, indeed, seem to have had a comparatively happy, uneventful life. But, of course, to balance that is the permanent antipathy of people to admit causing worry to, or being caused worry by, their nearest kin. That general paralysis is commoner in the male than in the female I think is generally accepted, and in the Institute where I had the privilege of seeing those cases there was only one woman who might have been a general paralytic.

To bear out my remarks at an earlier stage refuting the hopelessness of these cases, I give the histories of one or two typical cases. The first case I should like to describe briefly is our most successful "cure." In the autumn of 1930 he was admitted to hospital and his credentials were along the standard certificate lines: "He is hallucinated; he is slovenly

in his actions, disorientated as to time and place, dirty in his habits and a nuisance to his relatives." Actually his appearance was rather horrible. His clothes were soiled with food, urine, and fæces. He was unkempt, unshaven and unwashed, his people remarking that he would not bother himself, yet at one time he had taken great pride in his appearance. Now he was listless and chuckled away to himself one minute and the next was weeping, yet, at one time, he had been a virile, active, and athletic young man. On examination it was found that the Wassermann reaction was positive both for blood and cerebrospinal fluid. Well, he was put on treatment almost immediately and responded very actively to the malaria infection. Indeed, he caused some anxiety by the severity of his rigors, of which he had the routine twelve, and was then subjected to necessary quinine treatment. The malaria having cleared up he was given twelve injections of tryparsamide during a period of six weeks. For the next three months he was given injections of an intramuscular preparation of bismuth and at the end of that time he had shown very remarkable improvement. He could now laugh at himself for having his hallucinations of grandeur, although he admitted still having them. With regard to his general appearance, his old pride had returned to a great extent, and he kept himself clean and carefully shaven. Gone was his listlessness and he proved to be a very useful and industrious fellow about the place. His treatment was continued, and when he was discharged from the Institute in the early summer months of 1933 he was, to all intents and purposes, his old self again. That man returned to his job as an attendant in a leading picture house, where I often see him at the present day. His superiors say that he is a very good servant and apparently the only difference in his conduct is that occasionally he loses his usual geniality and is inclined to be irritable.

Now permit me to describe a "failure." This was a man whose occupation was that of a mate on a cargo vessel. On admission to hospital his condition had not the hopeless appearance of the previous case, but, nevertheless, he had very definite symptoms. However, he was aware of his mental impairment, and it was only on very careful questioning that it could be said that he was suffering from grandiose ideas. He was also put on malaria and arsenic treatment, but with little or no avail. Here an interesting point crops up. In contrast to the previous case this man did not respond very actively to the malaria and his treatment was not a success. This, to my mind, indicates that the prognosis in these cases is dependent upon the reaction to the malaria infection. However, some people hold that it is not the malaria but the accompanying elevated temperature that gives the required results. Following upon this idea a course of graduated injections of a *B. coli* vaccine has been given. The temperature chart of one of the cases corresponds exactly to one of a very active tertian malaria. Unfortunately, I have only seen one such treatment, and that is quite insufficient for me to say whether it is a

valuable line of treatment or not. Certainly it did not appear to have the success attendant on malaria infection. To return to the actual cases whose treatment has been completed, I have developed the impression that the relative "cure" is dependent upon two main factors, firstly, the stage at which the disease is recognized and treated and, secondly, the reaction to the malaria infection. My impression is that the earlier the disease is recognized and treated and the more violent the malaria rigors, the better is the prognosis.

In discussing the cases of G.P.I. to which I refer, it has been borne home to me that prophylaxis, as in all diseases, is by far the best line of treatment. Why should anyone become a sufferer of neurosyphilis in any of its forms? It is admitted that adequate treatment in the early treatment of syphilis is preventive. Many people will argue as to the ignorance of people developing syphilis, but why should they not be educated? Notices are placed in out-of-the-way corners by the "Public Health Authorities," and are seen by only a few, and those few merely glance at them. Recently there was a propaganda film, entitled "Damaged Lives," which brought upon itself much adverse criticism, but I think it was one of the finest pieces of "herd" education yet released to the public. The grounds I have for stating this are the number of people who, on seeing this film, and realizing the dangers liable to follow upon the risks they had exposed themselves to, applied for advice at the various clinics for the treatment of venereal disease. Certainly a large number of these people were not infected but, to counteract that, there was a fair number who were, and who would not otherwise have applied for advice. Thus I think that a systematic education of the general public on the dangers of venereal disease should be carried through (for is not fear the emotion which most guides us in our actions?) and there would be much less need for treating G.P.I. in future.

AN UNUSUAL SURGICAL EMERGENCY: WOUND OF THE GROIN INVOLVING THE FEMORAL VEIN.

By Major C. B. C. ANDERSON,
Royal Army Medical Corps.

Mrs. X. was cutting cardboard on her kitchen table with a large sharp knife, when the knife slipped and the point entered her right groin; there was immediate and very profuse hæmorrhage, which the patient herself managed to control partially by local pressure and the application of a constricting bandage around the thigh below the wound. She was seen a few minutes afterwards by the orderly medical officer, who, introducing local colour, described the scene as strongly resembling a bull ring at the end of an afternoon's slaughter. The patient's condition was extremely grave and she was transferred immediately to hospital, where I saw her

about twenty minutes after the accident. She was practically moribund. The wound was examined in the theatre, and on removing the temporary dressings there was an immediate and very alarming flow of venous blood from a stab wound high up in the inner part of the groin. The patient's condition precluded any active interference, beyond controlling hæmorrhage by plugging with paraffin and flavine gauze followed by administration of a pint of saline intravenously. The patient was returned to bed and the usual measures for treatment of shock were instituted. Much to my surprise, she rallied to such an extent that I decided two days later that her condition warranted an exploration under a general anæsthetic.

She was accordingly anæsthetized with open ether, and while pressure on the plugging was maintained, the wound was enlarged so as to expose the structures in Scarpa's triangle.

A dissection of the main vessels was made and followed upwards, great difficulty being experienced owing to the necessity of keeping up pressure and to the disruption of tissues by the hæmatoma. The saphena-magna vein was ligatured and divided at the saphenous opening. On releasing pressure it was found that the hæmorrhage was coming from a wound in the common femoral vein, just below its exit from Poupart's ligament.

The main vein was ligatured below the site of hæmorrhage. This had no effect on control of the bleeding. The vein was then exposed above the plug, and ligatured just below Poupart's ligament. On releasing pressure there was again a very alarming flooding, which was controlled with difficulty. By gradual deep dissection and careful manipulation of the plug, a large branch which was obviously the profunda femoris vein, was found entering the main trunk on its posterior aspect at the site of the injury. This vessel was ligatured and at once all hæmorrhage ceased.

One was now able to see that there was a longitudinal slit one inch in length in the anterior wall of the femoral vein.

The failure to control hæmorrhage by ligature of the main trunk above and below the site of injury was accounted for by the entrance of the profunda vein on the posterior wall at this level.

Operation was followed by the administration of 600 cubic centimetres of citrated blood.

The further progress of the case was uneventful. The wound healed with slight sepsis. The amount of œdema which one would have expected with such interference with the venous return did not materialize.

She was sent home twenty-five days after operation, and kept under observation in bed for a month.

Slight œdema is present and superficial veins are dilated, but she is now able to walk about her house with a supporting bandage on the leg.

Echoes of the Past.

THE EXPEDITION TO CARTAGENA, 1740-1742

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps (R.P.).

Though the papers relating to the Spanish War of 1739-1742 have not yet been printed in the Calendars of State Papers Colonial Series, they were very thoroughly explored by Sir John Fortescue in describing the expedition to Cartagena in his History of the British Army. Otherwise the main authorities are Tobias Smollett's History of the Expedition, and the very readable account of the events witnessed by him in his capacity of a naval surgeon, to be found in the pages of *Roderick Random.* In search of details relating more particularly to the medical aspect of the war, the early numbers of the *Scots Magazine* and Colonel Johnston's invaluable *Roll of Commissioned Officers* have also been consulted.

As the war eventually petered out by the practical extinction of the opposing forces by yellow fever, the contemporary definition of this disease may be stated. "A bilious fever attended with such a putrefaction of the juices that the colour of the skin, which is at first yellow, adopts a sooty hue in the progress of the disease, and the patient generally dies about the third day with violent atrabilious discharges upwards and downwards. Nothing so effectually prevents or corrects the putrefaction as plenty of sweet water, fresh provision, and a liberal use of vegetable acids, such as limes, lemons, bananas, oranges, and other fruits natural to the West Indies."[1]

For fifty years the British and Spanish nations had been at variance over the right of free trade with the latter's possessions in South America. Owing to Walpole's policy, the country had been involved in no serious hosttiliies since the close of Marlborough's campaigns ; but in 1739 a burst of democratic patriotism following on the incident of Captain Jenkins and his ear, which was encouraged by the Opposition in the hope of turning out the Government, imposed on the Prime Minister the choice of resignation or war. Though under no illusions as to the probable consequences, he chose war.

During the preceding years Walpole's opponents, who now clamoured

[1] There was believed to be an intimate connection between scurvy and "putrid fevers." Antiscorbutics and drinks containing sugar were specially recommended as prophylactics. The immunity from yellow fever observed among some of the Spaniards was ascribed to their fondness for sirops.

loudest for war, had consistently opposed every measure to maintain the efficiency of the fighting services. They were cut down accordingly to the narrowest margin, and, as if to render recruiting as unpopular as possible, soldiers and sailors alike were submitted to shameful neglect and maltreatment. At this time, as for many years later, the highest military formation in time of peace was the regiment, administered, and even clothed by its Colonel, and usually called after his name. Outside this, there were practically no administrative services; there was no chance of combined training; and even the regiments, owing to their dispersal by detachments in billets all over the country, were rarely concentrated as such. The sick soldier was doctored and dieted by his regimental surgeon in a house hired for the regimental hospital. The surgeons, who obtained their positions either by purchase or interest with the commanding officer, were still regarded somewhat as his servants, though they held the King's commission. The surgeon's mates were warrant officers. A few depot hospitals were apparently in existence staffed usually by civilians. A hospital for sick soldiers is mentioned about this period as behind Buckingham House. There is no evidence of any kind of a Medical Directorate. The military functions of the Physician General to the Land Forces, Dr. Charles Peters of St. George's, and of the Surgeon General, were mainly concerned with patronage.

Hostilities commenced with a successful naval attack on Porto Bello by Admiral Vernon, and the popular imagination was excited by the idea of the immense plunder which could be got out of the Spanish Indies. A combined naval and military expedition was decided on; and on the admiral's insistence, Cartagena on the north coast of South America was made the first objective. In April, 1740, a number of troops were assembled under Lord Cathcart in the Isle of Wight, among them six recently raised regiments of marines, almost entirely composed of drafts from existing regiments. With these were united, apparently as an after-thought, some of the regiments from whom the drafts had been taken, their strength being completed with raw recruits, some without the strength even to handle their arms. Meanwhile four new battalions were ordered to be recruited in Virginia.

The time in the Isle of Wight seems to have been well spent. The new regiments were a very mixed lot, and required drill and discipline; the more impossible recruits had to be weeded out. All this was very thoroughly done by Cathcart and his brigadier. The subsequent behaviour of the men under fire was beyond criticism.

It has been agreed that, in view of the seasonal prevalence of sickness in the West Indies, the expedition ought to sail not later than June; but in July the escorting vessels were still unmanned. On August 3 the six marine regiments and the 15th (E. Yorks.) and 24th (S. Wales Borderers) were embarked. Contrary winds and official blundering, however, prevented them getting to sea. Though the ships remained in Spithead,

sea rations only were issued, in spite of the General's protests. After six weeks of it, scurvy appeared, and from one cause or another, there were 60 deaths. Further delay occurred owing to the threatening action of the French government. A larger escort was demanded, and two regiments, the 34th (1st Border Regiment) and 36th (2nd Worcesters) were drafted into the men-of-war as naval ratings. The same fate befell 600 of the marines. At this time an infectious fever of some sort was reported prevalent in the fleet.

The expedition, in eighty transports, at length got to sea on November 4. Smollett, in his History, mentions a hospital ship (possibly the frigate "Scarborough") on which, no doubt, the medical staff officers and stores were embarked. Their names are thus given in the *Scots Magazine* :—

> *Physician General :* George Martin [M.D.].
> *Surgeon General :* Thomas Mascie.
> *Surgeon's Mates :* George Colquhoun and Joseph Darby.
> *Director [and Purveyor] General of the Hospital :* John Cathcart.
> *Chief Surgeon of the Hospital :* Robert [Barclay] Dalrymple.
> *Surgeon's Mates :* Mackenzie, Whiteman, Bruce.
> *Apothecary :* Andrew Melvil.
> *Apothecary's Mates :* Mungo Muir, Watson.

The predominance of Scotsmen will be noted. The Physician General died soon after landing at Cartagena, and seems to have been succeeded by Robert Dalrymple. From Johnston's Roll it would seem that the Director of Hospitals survived the war, and presumably with credit, for he held the same office in North America in 1746, and the following year in Flanders. He died in 1766. Whether he was a medical man or not is not evident. In Marlborough's campaign's a medical qualification was not held as necessary for the appointment. George Colquhoun was probably the same who held a commission as surgeon of Wynyard's Marines (47th) in 1743. Of the regimental surgeons, a Dr. Daniel Martin was appointed to Robinson's Marines on their formation in 1740. The Roll provides the names of the following, who presumably embarked with their regiments and survived. Thomas Galpin, Wynyard's, 1739-43; Thomas Dundas, Spottiswood's (a Virginian regiment), 1739, living in 1746; John Dennis, Lowther's, 1739-48; William Young, Wolfe's (44th), 1739-45; Robert Elliot (27th Foot), 1740-45. The death of Surgeon Donald Mackenzie, of Colonel Huske's regiment, was reported from Jamaica in 1741.

Foul weather was encountered at the commencement of the voyage. On November 25, the weather was sultry and there seems to have been a medical inspection on board Smollett's ship, for he records that "a man belonging to the 'Chichester' jumped overboard and drowned himself in resentment for having undergone the shameful discipline of vermin." A few days later he mentions that the "whole fleet was sickly from the prevalence of an ardent fever."

The bulk of the ships reached Dominica on January 3, where it was found that more than 100 soldiers had died during the two months voyage, and, of the 600 marines transferred for seamen's duty to the men-of-war, hardly one was fit for duty. The following day Lord Cathcart died of dysentery, and Brigadier Wentworth succeeded to the command. During the short stay in the island, the sensible precaution was taken of removing the sick to tents on shore. No fresh fruit or vegetables were obtainable; but the removal from the intolerable atmosphere of the troop decks, where they had lain "suspended in rows fourteen inches apart, deprived of the light of day and breathing nothing but the noisome atmosphere exhaling from their own excrements and diseased bodies," is said to have wrought a marvellous improvement among the scurvy patients.

At Jamaica, where there was a month's fatal delay, junction was effected with Vernon's squadron. Here the newly formed American regiments were picked up. They were untrained, disorderly and mutinous, the last because the Home Government had omitted all arrangement for rationing them. They were also extremely sickly. The following sick return from Jamaica is quoted by Fortescue. Embarked in England and America in October, 9,000. Died, officers 17, other ranks 600. Remaining in hospital 1,500.

The expedition remained in Jamaica till March 7, and arrived off Cartagena on the 20th, the French fleet, a potential source of danger, having been forced to go home on account of the sickness of the crew.

The town lies on a low sandy island, then a much favoured habitat of the culicine mosquito, and yellow fever was endemic. This, with the island of Terra Bomba to the south of it forms a great natural harbour 40,000 acres in extent. The outer forts of the harbour entrance were demolished by the ships' guns, and two days later Harrison's (15th), Wentworth's (24th) and the six regiments of Marines were landed on Terra Bomba to capture the more formidable fort of Boca Chica which remained to be subdued.

The admiral, rightly impressed with the need for rapid action, urged an immediate assault. Wentworth, however, insisted on landing the heavy guns and investing the fort in due form. When, ten days later, the assault was delivered, the garrison evacuated the position almost without firing a shot. The battle casualties from the time of landing were 130; but the rainy season had set in, 250 men had died, and there were 600 in hospital. Then began one of the most discreditable incidents in our naval or military history. Mr. Wentworth (to use the contemporary designation), though a painstaking student of his profession and a good subordinate, was wanting in most of the qualities necessary for command in the field. He was irresolute and incapable of any action not provided for in the drill book. Mr. Vernon, "a man of weak understanding, strong prejudices, boundless arrogance and overbearing passions," and at the moment a popular hero, was certainly well qualified from his local knowledge to offer advice on matters of general policy. But he started to teach the soldier how he

conceived he ought to set about his job in such a tactless and offensive manner that the worm turned. "Their animosity daily increased, and their mutual contempt became at last so excessive that the glorious cause in which they were engaged seemed less the object of their attention than the means of effecting each others' disgrace."[1]

The seamen who, owing to the utter inexperience of the young soldiers and the absence of competent artificers and artillerymen, had so far done all the hard work, were now called upon to re-embark the troops and siege train and transfer them to the head of the harbour. Here they landed the men, but without tents or tools, on April 16th. An acrimonious correspondence commenced. Vernon, as before, urged an immediate advance on Fort Lazar, the fall of which would win the town. The General considered regular approaches were necessary. Vernon abused him for not going ahead; he reproached Vernon for not taking in the fleet and bombarding the town. Meanwhile the men, who had rapidly sickened, began to die in their bivouacs. At length on the 20th Wentworth decided to assault without naval co-operation, by which time the Spanish were fully prepared to receive him. Before break of day, 1,200 men from the 15th, 24th, 34th and 36th, headed by their grenadier companies, marched to the attack. "Unfortunately the guides were slain before they reached the walls. The scaling ladders, being applied at random, proved too short. The officers were disconcerted for want of orders. A general confusion ensued, and the troops were obliged to retire with the loss of 600 men killed and wounded."

Campbell's description, though generally correct, does less than justice to the behaviour of the troops. Brigadier Guise, who led them, set a fine example of bravery, but neither he nor his officers seem to have realized the action required. The men, in the formation laid down for "street fighting," steadily returned the enemy's fire for three hours, and then retired under orders, covered by Wolfe's marines.

On return to camp, rain commenced to fall heavily. Sickness was universal, and on the 28th the soldiers were re-embarked, having from deaths, wounds, or sickness, lost half their effectives. Until May 5 the ships remained in the harbour. The situation was a sufficiently ghastly one for the sick and wounded. "They were squeezed into certain vessels which thus obtained the name of hospital ships, though methinks they scarce deserved such a creditable title, seeing that few of them could boast of their surgeon, nurse, or cook, and the space between decks was so confined that the miserable patients had not room to sit upright in their beds. Their wounds being neglected, contracted filth and putrefaction, and millions of maggots were hatched amidst the corruption of their sores, which had no other dressing than that of being washed by themselves in their own allowance of brandy. Nothing was heard but groans, lamenta-

[1] Campbell, "Lives of the Admirals."

tions, and the language of despair invoking death to deliver them from their miseries. What served to encourage this despondency was the prospect of those poor wretches who had strength or opportunity to look around them, for there they beheld the naked bodies of their fellow soldiers and comrades floating up and down the harbour affording prey to the carrion crows and sharks who tore them in pieces without interruption, and contributed by their stench to the mortality that prevailed."[1]

The seamen, though numbers had been landed at different times as carriers for the troops and for bringing up stores, suffered less severely. Smollett states that every man-of-war could have lent one surgeon or more to the transports, but by this time Wentworth was not on speaking terms with the admiral, and could not bring himself to ask it as a favour.

Within a month there were 1,100 deaths, and for the next three weeks in Jamaica the mortality was 100 a week. The officer casualties were equally heavy, 18 had been killed in action and 76 had died. Moreton's Marines had lost 16, Wynyard's 15, Harrison's regiment 14, and Wentworth's 10. On August 23 the survivors were embarked for a descent on Santiago de Cuba. After landing on the island, the general declined the 90-mile march through the jungle. The troops lay idle in camp till at the end of November there remained only 300 fit for duty when they were re-embarked. In February, 1742, a battalion of the Royals, the 6th (Royal Warwicks), and the 27th (R. Inniskilling Fusiliers) arrived from England. The Warwicks, who started 770 strong on November 8, had 16 deaths on the voyage. Wentworth wrote home that he found the troops on arrival in better health than could be expected, but that they had since sickened, "which is not to be provided against, as there are not houses sufficient to lodge them on shore, nor can we procure fresh meat."

A return covering the period October 26, 1740, to February 26, 1742, shows the deaths among officers to have been 284, and among other ranks 10,000. The figure for officers include 21 staff officers, which at the time seems to have been the term applied to adjutants, quartermasters and regimental surgeons.

In March, a force selected from apparently healthy men started for Porto Bello. By the end of the voyage, which took nineteen days, the 6th Foot had had 98 deaths. Sickness or death had reduced the fighting strength by 1,000, and it was decided to return. During the absence of the expedition there had been a further 500 deaths in Jamaica. This was the end, and the survivors, the Americans having already been disbanded, were recalled to England.

Of those who went out nine out of every ten left their bones in the West Indies. By the time the remnants landed in England popular interest had shifted to the Continent where the War of the Austrian Succession was raging. That any lessons were absorbed is more than doubtful, when we

[1] Smollett.

find that during the last seven years of the century the troops in garrison in the Windward and Leeward Islands died at an average rate of 7,000 a year.

The military medical personnel, including the hospital staff, seem to have been in accordance with the recognized establishment. As was always the case, they had to rely for their sick attendants on soldiers detailed from the combatant units. Their numbers were reduced by sickness, and there is no evidence that as individuals they failed in their duty under the impossible conditions to which they were subjected.

The miserable accommodation provided for troops on board ship remained much the same for the next fifty years or more, and the Army surgeons were powerless to improve them. Towards the end of the century the sailors found an able advocate in Rodney's Fleet-Surgeon, Sir Gilbert Blane, who succeeded in getting something done towards improving their life on board ship.

Current Literature.

HILL, A. B. **The Inheritance of Resistance to Bacterial Infection in Animal Species. A Review of the Published Experimental Data.** *Med. Res. Council Spec. Rep. Ser. No. 196.* 71 pp., 2 figs. [67 refs.] 1934. London: H.M.S.O. [1s. 3d.]

In this valuable monograph the author reviews in considerable detail the extensive literature that has accumulated, mainly within recent years, on the experimental study of inheritance to bacterial infection. Such a review has been badly needed and will be welcomed by all those to whom this problem is of interest, for the recorded data and the conclusions that have been drawn from them are not of a kind that offer a clear picture to the cursory reader.

Dr. Hill states the problems at issue clearly and concisely. Assuming genetic as opposed to acquired characters to be of importance in resistance to bacterial infection—an assumption the inherent probability of which is certainly increased by the evidence under review—it remains to be determined what grade of resistance these genetic factors are capable of conferring, whether this resistance is specific or non-specific in the immunological sense, and, in particular, whether genetic influences are, on the average, more or less important than environmental factors, including the acquirement of immunity as the result of clinical or subclinical infection.

To these questions the evidence at present available yields no clear answers. In regard to the degree of resistance that can be induced by selective breeding within an animal strain or species, it is noted that the term "resistance" has been used by different workers to include a range of

differences extending from a slight delay in the time to death after experimental infection to a survival of a relatively large proportion of the infected individuals. The differences between the selected and unselected groups in final mortality are in some cases (though by no means in all) very large, but there would seem to be no evidence that, by selective breeding throughout a considerable number of generations, a strain can be developed that is uniformly resistant to a particular bacterial infection, even when the test of resistance is a single injection of bacteria in a dose that fails to kill 100 per cent of unselected controls. No adequate study has yet been made of the response of selected animals to a prolonged risk of contact infection. The problem of the specificity or non-specificity of genetic resistance is as yet unsolved. Webster (this *Bulletin*, 1933, v. 8, 695), in his earlier work, suggested that genetic resistance is quite non-specific, operating against harmful agents as widely different as a pathogenic bacterium on the one hand and a poisonous metallic salt on the other, but certain of his later experiments are not in accord with this view, nor are the results recorded by several other workers. Probably, as Dr. Hill emphasizes, no simple or generalized answer is attainable. Resistance is very unlikely to depend on any single genetic character. It may well be due to a fortuitous combination of separate factors, some specific in the immunological sense, others operative over a wider range. It is in the evaluation of the relative importance of genetic and acquired immunity that the data under review are least satisfactory. In some experiments, owing to the method of selection employed, it is frankly impossible to differentiate one effect from the other, and the conclusion that observed differences depend on genetic factors is arrived at by ignoring the obvious possibility that acquired immunity has been largely concerned. Other workers have, however, faced this technical difficulty and striven to surmount it in a variety of ways, and Dr. Hill considers that the results recorded establish a strong case for the development of some degree of genetic resistance in the absence of any acquirement of immunity from infection of the females or their offspring. It does not, of course, follow that, in the natural history of an infective disease in human or animal herds, selection plays a more important part than natural immunization in raising the average resistance; indeed, we have as yet no data on which we can base any certain conclusions in regard to this point.

Dr. Hill concludes his monograph by setting out the requirements that must be fulfilled in order that unequivocal results may be obtained from experiments of the kind under review, and his report will certainly repay careful study by anyone who desires to work in this particular field.

W. W. C. Topley.

Reprinted from "Bulletin of Hygiene," Vol. 9, No. 12.

MacCallan, A. F. **Role of the Gonococcus in Purulent Ophthalmia in Warm Climates.** *Archives of Ophthalmology.* December 1934, v. 12.

In this interesting paper, Dr. MacCallan draws attention to the fact that ophthalmia neonatorum is extremely rare in Egypt and Palestine and that in these countries eye infections by the gonococcus are non-venereal in origin and are spread by means of fingers, garments and towels.

Gonococcal conjunctivitis is characterized in Egypt by the frequency of subacute and chronic forms while acute cases are much less fulminating than similar infections in the United Kingdom. For this reason the author at one time thought that the organism concerned might not be the same as that causing urethral infections, but subsequent investigations have shown no apparent difference between the strains.

The gonococcus is stated to be much less dangerous to the cornea than is the pneumococcus, but in the presence of trichiasis entropion the cornea is rapidly destroyed by the gonococcus or other infecting organisms.

The number of gonococcal infections increases in Egypt with the spring rise of temperature, the existence of trachoma being a predisposing cause, but the presence of pannus affords some degree of protection to the cornea.

Robson, W. A. **A Hundred Years of Public Health Administration: Chadwick Public Lecture.**

A century ago there was in England no organized system of local government and the machinery then in being was unable to cope with the problems which had arisen as a result of the industrial revolution.

A uniform system of government first came into existence by the passing in 1835 of the Municipal Corporations Act, but this Act only affected three-fourths of the incorporated towns and consequently there were few general signs of improvement in public health administration.

The first real impetus towards betterment followed on the report of the Poor Law Commission of which Chadwick was secretary, and the revelations contained therein led up to the reports of the Royal Commission on the Health of Towns of 1843-1845.

The first Public Health Act was passed in 1848 and under it, Borough Councils became the Sanitary Authority in corporate towns while Boards of Health could be set up elsewhere.

In 1871 the Royal Sanitary Commission in its report drew attention to the defects of the existing system and in the following year a Public Health Act was passed and this was further consolidated and extended by the great Public Health Act of 1875 which set up local Boards of Health. At this period in the evolution of our administration, boards were usually formed to deal with definite subjects, such as schools, highways, boards of guardians, etc., but these *ad hoc* bodies have now disappeared, the duties of all of them having been taken over by County, District and Parish Councils, the process

being completed by the Local Government Act of 1929 which abolished the guardians.

In the nineteenth century, Public Health Administration was concerned with the material environment; water supplies, drains, sewers and so forth. In the twentieth century the trend is towards personal services such as Maternity and Child Welfare, the treatment of tuberculosis and venereal disease and similar activities, while the whole conception of public health has become radically transformed.

In the past many improvements have arisen from fear engendered by epidemics or other public catastrophies; in the future our civilization should be tested by its ability to promote the welfare and happiness of the people from higher motives.

Colonel G. L. McKinney, M.C. **Recent Developments in Medical Field Equipment and Transport at the Medical Department Equipment Laboratory, U.S. Army.** *Military Surgeon.* Vol. 76, No. 1, p. 11-25.

The Medical Equipment Laboratory of the United States Army was established in 1920 at Carlisle Barracks, Pa., for the experimental development and standardization of field medical equipment and transport. This article deals with work carried on in the Laboratory during the past three years.

A new type of ambulance waggon has been developed, the basic feature of which is the provision of a framework for carrying stretchers which can be installed in any light truck of the nature of the Ford or Chevrolet. The prime objective in developing this type was the possibility of rapid and certain mass production, but it should be noted that it is only for use on roads.

The problem of the provision of ambulance waggons is complicated by the uncertain future status of the animal-drawn vehicle and by the necessity for a reliable cross-country waggon. A front line cross-country vehicle need not have great weight-carrying capacity, and a machine weighing less than a ton should be ample, but this type of chassis is no longer made and a really light vehicle like the Ford ambulances of the A.E.F. will not be available in the future; the lightest practicable vehicle must be used, and to ensure efficient traction and flotation should be equipped with extra large diameter low-pressure tyres disproportionate to the size and weight of the vehicle. Two different types of ambulance waggon for front-line and cross-country work are under consideration; one of these is a half-track laying type, while the other consists of a light passenger chassis with two rear driving wheels in tandem on each side.

A new type of animal-drawn ambulance waggon has been developed for use with cavalry. It takes the form of a two-stretcher waggon with a total weight of 800 pounds and an over-all height of 4½ feet. Fitted with

"doughnut" tyres and drawn by two horses, this waggon can easily keep up with a cavalry column.

For the carriage of battalion medical equipment a light mule cart has been designed. This cart weighs 288 pounds empty and 783 pounds loaded. The wheels are pneumatic tyred and shafts of aluminium tubing are on trial.

Another problem under investigation is the development of a complete surgical hospital of 100 beds, including all equipment and technical organic transport. For such a unit it has been decided to use electricity as the standard method of sterilizing, of heating the operating tent, operating the portable X-ray apparatus and lighting the hospital; the decision being concurred in by the Chief of Engineers, who has also stated "that electric generators needed for the surgical hospital (mobile) should form a part of the organized equipment of the hospital."

A twenty-five-k.w. generator appears to meet the requirements.

Amongst other projects, either completed or under investigation, are the provision of a pack saddle, medical chest and cacolets for use with cavalry, medical field laboratories and an improved hand litter (stretcher).

In the construction of the last named, the poles, 1·54 inches in diameter, and spreader bars (traverses) are of duralumin tubing, while the latest model has turned maple handles inserted in the tubing, the duralumin having been found unsatisfactory as a handle.

The article is full of useful ideas and is well illustrated.

Reviews.

ECHOES OF OLD WARS, 1513—1854. A martial anthology complete and annotated by Colonel C. Field, R.M.L.I. London: Herbert Jenkins, Ltd. 1934. Pp. 256, with 16 illustrations. Price 10s. 6d.

Colonel Field's book is of peculiar interest as it consists of a number of personal and quite unofficial letters written at the time by those who were actually on the field of battle. Letters written by officers and men describing what fell under their immediate notice are life-like and much more interesting to the general reader than official reports, for these never seem to appeal to the imagination or to bring a vivid picture to the eye. All the letters are interesting, but the account by Dr. Gidney, M.O. of the 15th Hussars, of what he actually saw of the battle of Waterloo will certainly appeal to all officers of the Corps. Dr. Gidney describes his feelings when his regiment which he loved so well was ordered to another part of the field and he was forbidden to accompany it because of the danger, and medical officers were valuable. "For the first time in my life" he says "I hated my profession; my heart was with the old Regiment. I had tasted

a bit of fighting and rather liked it and to remain alone a mere spectator was most unpalatable." Colonel Field is to be congratulated on having brought all these letters into the space of one volume. The illustrations are from old engravings, many of which are in his own collection and are very well reproduced.

A Study of the Strategy and Tactics of the Mesopotamia Campaign Illustrating the Principles of War. By A. Kearsey, D.S.O., O.B.E., *p.s.c.* Aldershot: Gale and Polden, Ltd. 1934. Pp. 192. 4 maps. Price 5s. net.

The book is doubtless intended for officers who are preparing themselves for promotion examinations or entry to the Staff College and as such serves its purpose well. The first eleven chapters give a clear account of the various operations which at last culminated in the capture of Baghdad in April, 1917. In the next five chapters the author shows how these operations illustrate the fundamental principles of war. The book is quite readable in spite of the compression of the subject matter. Very little is said about the administrative situation in the various battles and nothing at all about the medical problems.

Tropical Diseases Bulletin. Vol. 31. Supplement, December, 1934. "Medical and Sanitary Reports from British Colonies, Protectorates and Dependencies for the year 1932." Summarized by H. Harold Scott, M.D., F.R.C.P., D.P.H., etc. Assistant Director of the Bureau of Hygiene and Tropical Medicine. Pp. 219. Price 5s. net.

For the fourth year in succession Dr. Scott has summarized the Medical and Sanitary Reports of our colonies, protectorates and dependencies varying in size from Nigeria with just under 20 million inhabitants to the Falkland Islands with a total population of about three thousand.

The summaries represent a very considerable amount of labour and are of great value especially to workers engaged in the colonies and dependencies and to all those interested in health conditions in these countries, while the Supplement as a whole is a monument to those workers, who in our scattered possessions continue the fight against disease for the benefit mainly of other races.

The evidences of trade depression and the consequent restrictions on expenditure are to be noted chiefly in the African colonies where the sums allocated for Medical and Sanitary Services in 1932 were on a lower scale than in the previous year. In spite of this limitation of funds there would appear to be no decrease in the volume of work accomplished.

Most of the reports state the actual amounts expended on health work during the year while many also show this as a proportion of the local revenue. While, in view of the many varying factors involved, it would be unwise to institute too rigid a comparison between expenditure

and the results as shown by vital statistics it would appear that in general there is some parallelism, or in other words these summaries appear to show that where money is available and well spent satisfactory value is obtained.

MELANCHOLIA IN EVERYDAY PRACTICE. By Edwin L. Hopewell-Ash, M.D. London: John Bale, Sons and Danielsson, Ltd. 1934. Pp. 136. Price 7s. 6d.

This monograph is intended to help the general practitioner in the diagnosis and treatment of manic-depressive psychosis in its early stages. The book is clearly written and the various phases of this form of mental disorder are well illustrated by clinical examples. It should prove a valuable addition to the general practitioner's library.

A PATHOLOGY OF THE EYE. By Eugene Wolff, F.R.C.S.Eng. London: H. K. Lewis and Co., Ltd. 1934. Pp. 284, with 124 illustrations. Crown 4to. Price 28s. net.

This is a comparatively small volume of eighteen chapters most of which deal on a regional anatomical basis with the pathological processes occurring in the eye and its surroundings.

Apart from some rather irritating evidence of hasty choice of language or imperfect revision, it is essentially a readable book dealing shortly and clearly with the morbid processes described.

The book is illustrated with a wealth of well chosen figures, anatomical and histological, the excellence of which it would be difficult to over estimate; these combined with some pathological detail and a considerable amount of relevant clinical descriptive matter make the book easy and interesting reading especially to those whose knowledge of the eye work is not as yet very profound.

This book can be recommended with confidence to those who require a short and practical introduction to the essentials of the pathology of the eye.

J. B.

Notices.

"WELLCOME" BRAND DIPHTHERIA PROPHYLACTIC A.P.T.

ALUM-PRECIPITATED TOXOID (A.P.T.) of high immunizing efficiency made at The Wellcome Physiological Research Laboratories is now available commercially and is issued by Burroughs Wellcome and Co. in germ-proof containers of 1 cubic centimetre and 5 cubic centimetres.

The discovery that Alum-Precipitated Toxoid (A.P.T.), even in one dose, is a prophylactic of extraordinarily high immunizing power in animals was made in The Wellcome Physiological Research Laboratories in 1926; its use in human preventive medicine was referred to in 1931. Since that date the high immunizing efficiency in human beings has been established, but progress has been cautiously slow because of the risk of causing tissue response at the site of injection; this, though medically trivial, may disturb parents. The efficiency of A.P.T. probably depends on the deposition of the relatively insoluble aluminium-toxoid body at the site of injection; from this, the immunizing toxoid is gradually liberated. The complex toxoid body, however, excites a tissue response, causing a small painless nodule. This tissue response is probably an essential factor in the excellent immunization which occurs.

Experiments, as yet unpublished, made in The Wellcome Physiological Research Laboratories, have shown that in animals two spaced injections of one-tenth, or less, of the ordinary human dose will give more rapid or higher immunity than one single dose. It is possible that a similar method may prove useful in human immunization, the chance of troublesome local tissue response being much less by this method.

"HYPOLOID" CALCIUM LÆVULATE.

BURROUGHS WELLCOME and Co., Snow Hill Buildings, London, E.C.1, have issued "Hypoloid" Calcium Lævulate in ampoules of one gramme.

This product has been introduced to meet the demand for a calcium product for injection in cases where calcium therapy is indicated. It contains 14·8 per cent of calcium and is non-toxic in therapeutic doses.

"Hypoloid" Calcium Lævulate is indicated in the treatment of tetany, in the vomiting of intestinal obstruction, in cœliac rickets and as a pre-operative measure in various surgical operations.

It is issued in boxes of five "Hypoloid" ampoules.

THE ROYAL SANITARY INSTITUTE.

The Health Congress, which is organized by the Royal Sanitary Institute, is to be held at Bournemouth from July 15 to 20 next. The Right Hon. the Earl of Malmesbury, D.L., J.P., will be the President of the Congress.

The programme of the Congress will be divided into sections dealing with Preventive Medicine; Architecture, Town Planning and Engineering; Maternity, Child Welfare and School Hygiene; Veterinary Hygiene; National Health Insurance; and Hygiene in Industry. There will be special conferences of Representatives of Sanitary Authorities, Medical Officers of Health, Engineers and Surveyors, Sanitary Inspectors, and Health Visitors.

A large Health Exhibition will be arranged in connection with the Congress, in the Winter Gardens.

NEW STAPHYLOCOCCUS SEROLOGICAL PRODUCT.

Immunization with Staphylococcus Toxoid has been used recently as a combined method of prophylaxis against, and treatment of, chronic infections. In Melbourne and Toronto highly promising results from a considerable number of patients have been reported in conditions such as recurring boils and carbuncles and chronic staphylococcal skin diseases, e.g. acne, sycosis and blepharitis. English experience is not yet large, but the general results, obtained mainly during the course of an investigation by the Therapeutic Trials Committee of the Medical Research Council, agree with those reported elsewhere. This investigation was carried out with Staphlylococcus Toxoid supplied by the Wellcome Physiological Research Laboratories. In a considerable number of patients "cure" has been obtained; in many "improvement"; and in a small number "no improvement." There are on record a few instances of puzzling relapses in patients who had shown rapid disappearance of long-standing symptoms.

Two preparations are issued: "Wellcome" Brand Staphylococcus Toxoid A—for Active Immunization (1:10 dilution) and Staphylococcus Toxoid B—for Active Immunization (Undiluted Toxoid), each in containers of one cubic centimetre. Supplies may be obtained from Burroughs Wellcome and Co., Snow Hill Buildings, London, E.C.1.

ERRATUM.

"NOTES ON THE TREATMENT OF ACUTE PNEUMONIA BY A CONVALESCENT SERUM."

February Number, page 123, *delete* from "The injection" in line 38 to "worthy of trial." in line 40, and *substitute:* "The injection of whole blood of a patient convalescent from pneumonia, whose serum has been first proved to be free from malaria and syphilis, into the muscles of an actively ill patient is also put forward as worthy of trial."

CHADWICK PUBLIC LECTURES IN MAY AND JUNE, 1935.

Date and Time	Place	Lecturer	Subject	Chairman
May Thursday, 23, 5.30 p.m.	LONDON. Manson House, 26, Portland Place, W.1.	Miss Noel Tidy, C.S.M.M.G.	Physical Exercises: Educational and Preventive. (Illustrated by lantern slides and films)	Sir James Crichton-Browne, M.D., F.R.S., Chadwick Trustee
June Thursday, 6, 5 p.m.	LONDON. The Chelsea Physic Garden. Swan Walk, S.W.3.	Sir E. John Russell, D.Sc., F.R.S.	Modern Changes in Food Production: Their Influence on Our Sources of Supply	Sir William J. Collins

Correspondence.

CLASSIFICATION OF TYPHUS GROUP OF FEVERS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—In the case of the typhus group of fevers the connection between the antigen and the virus is so uncertain that I doubt if a classification based on serological findings can be termed scientific. At any rate from the point of view of a practical health officer, I feel compelled to enter a mild protest against the adoption of a classification which includes in the same sub-group two diseases so ætiologically different as classical epidemic typhus and Brill's disease, and would ask you to picture the feelings of say a D.A.D.H. of a base, on receipt of a wire to the effect that X19 typhus is raging in the area in which a labour force is being recruited.

The classification based on the vector is admittedly unscientific and even somewhat confusing. It is, however, practical and information based on it conveys a definite picture of the actual conditions.

Army School of Hygiene,
Aldershot.
March 16, 1935.

I am, etc.,
H. A. EMERSON,
Colonel.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

DEAR SIR,—In reply to Colonel H. A. Emerson's letter on the classification of the Typhus Group of Fevers may I mention the following points:—

(i) Brill's disease is now considered by some American workers to be

recrudescent classical typhus in patients who have already had an attack of that disease. If this work is confirmed the ætiology of the two diseases is identical.

(ii) Endemic typhus is considered to be distinct from Brill's disease—it never occurs except as sporadic cases and, therefore, could not "rage" in any community—nevertheless it may in a lousy community become the starting point of classical epidemic typhus. (Reference Mooser and Dummer, 1930.) The hygienic problem he postulates resolves itself therefore into the simple procedure of "Bringing forth the Thresh."

(iii) As regards the dropping of the vector classification we read of cases reported from India with others labelled "Tick Typhus" with a + + + reaction to X19. We hear much of "Tick Typhus" without one shred of evidence in many cases that the patients have ever been bitten by ticks, and none to show that they may not have been bitten by mites or fleas. Some of these cases are stated to be + + + to XK, others indefinite.

It is no longer possible to cover the typhus group on a vector classification without making this so complicated that the ordinary medical officer will not bother with it, or without accepting as gospel statements which have no supporting evidence—hence our effort to adopt a simpler classification which fits known facts and is based on simple laboratory tests. There can be no objection to making an additional statement with regard to the transmitting vector whenever this is definitely known. But it is misleading to suggest that it is possible or ever will be possible to determine the vector responsible for each outbreak or for each sporadic case of the disease.

The first statement in Colonel Emerson's letter may be strictly true—medicine is not an exact science. However, I think this matter may be safely left in the hands of one of the originators of the Weil-Felix reaction, who so kindly co-operated in drawing up the table.

I am, etc.,

J. Heatly-Spencer,

Colonel.

No. 5. May, 1935. Vol. LXIV.

Journal

OF THE

Royal Army Medical Corps

ISSUED MONTHLY

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VOL. LXIV. MAY, 1935. No. 5.

Journal

of the

Royal Army Medical Corps.

Original Communications.

BACILLUS DYSENTERIÆ, SCHMITZ.

(WITH A BRIEF NOTE ON CERTAIN OTHER NON-MANNITE FERMENTING BACILLI.

BY MAJOR J. S. K. BOYD,
Royal Army Medical Corps.

PART I.—*B. DYSENTERIÆ* SCHMITZ, AS REPORTED FROM COUNTRIES OTHER THAN INDIA.

ALTHOUGH references to this organism appear in earlier literature, the first complete description of the bacillus which now bears his name was given by Schmitz in 1917.

As the original article is not at present accessible to the writer, the following quotation taken from an article by Murray published in this Journal in 1918 is given.

"Schmitz investigated an epidemic of dysentery among Roumanian prisoners of war. It was typically a contact epidemic occurring during the months of January and February (1916).

"The unfavourable conditions of food, the extremely insanitary condition of the prisoners, insufficient heating arrangements or other protection from climatic conditions during a very severe winter enabled the epidemic to spread at this unusual time of year. There were 815 cases, of which 104 showed typical dysenteric stools, while the remainder had more or less severe diarrhœa with or without traces of blood and mucus. The duration of the attack was ten to fourteen days, and it required six weeks before recovery was complete. Of 104 cases, 5 died of dysentery, and 58 others

out of the original 815 cases died of pneumonia. From the earliest part and throughout the epidemic, bacilli of the dysentery group were recovered from the stools of the patients. It was only possible to investigate 79 patients, but they were examined very thoroughly. As many colonies as possible were picked off from each plate. Bacilli which could be pronounced dysentery bacilli were found in 22 patients, and these were only found in the typical blood and mucus stools. Stools which were merely watery were negative. Twelve plates gave 138 colonies, of which 61 proved to be dysentery bacilli, and out of 38 subcultures from 9 plates 22 were dysentery bacilli (57·89 per cent). Out of another 39 cases the bacillus was found in 19; the stools of the rest were fæcal."

A description of the organism is then given to which reference will be made at a later point, and the author continues :—

"In only one case was any other type of dysentery bacillus found; this proved to be a 'Y'.

. . . . . .

"That this organism (i.e. Schmitz' bacillus) is to be regarded as the causal agent of the epidemic is evidenced by the fact that it was only found in the sanguino-purulent portions of the fæces, where it alone occurred, and further that the sera of a series of patients agglutinated this bacillus in high dilutions."

The occurrence during the war and post-war periods of cases of dysentery apparently caused by *B. dysenteriæ* Schmitz was by no means limited to the outbreak described above.

Thus Murray in his collection of dysentery bacilli identified six strains of this type, four of which came from France or Flanders, and two were of unknown origin. He concluded that *B. dysenteriæ* Schmitz is a clearly defined and homogeneous species.

Thomson and Mackie (1917) isolated from cases of dysentery in Egypt an organism biochemically similar to the Schmitz bacillus.

Andrewes (1918) described as *B. ambiguus* an organism which was probably *B. dysenteriæ* Schmitz. This occurred among strains which had been collected from one or other of the war theatres.

Among the various types of dysentery bacilli isolated from cases in the Salonika Army, Dudgeon describes under the name of *B. para-Shiga* + an organism which corresponds biochemically with *B. dysenteriæ* Schmitz, and which he believes to be identical with this organism. This bacillus was frequently isolated, and Dudgeon in the Central Laboratory investigated thirty strains. In one case the patient's serum agglutinated the organism isolated from the stools.

Hirschbruch and Theim (1918), in examining 214 cases of dysentery, isolated bacilli of the Schmitz type in 52 (24 per cent). In one fatal case with a typical history of dysentery there was found post mortem severe purulent colitis with catarrhal enteritis in the lower part of the ileum and swelling of individual follicles. *B. dysenteriæ* Schmitz was readily

cultivated from the intestine, but not from the bile, liver or spleen. A laboratory assistant working with this material was seized with slimy diarrhœa which lasted a fortnight, and *B. dysenteriæ* Schmitz was isolated from cultures of the stools. The authors consider the Schmitz bacillus a definite cause of dysentery.

Kirschner and Segall (1920) record the isolation of *B. dysenteriæ* Schmitz during the 1920 epidemic of dysentery in Vienna.

Tanaka (1923) records from Japan an organism resembling Schmitz bacillus recovered from two patients with dysentery and three with mild diarrhœa.

Ornstein (1920-21) made an exhaustive research into the characters and morphology of Schmitz bacillus, and concludes that it is a distinct and characteristic species which produces a well-marked and specific antigen. Mention is made of somewhat similar species which can, however, be differentiated biochemically and serologically. This one organism which he names *B. fallax* can be differentiated by its power of producing acid from saccharose after prolonged incubation, while another, *B. inconstans*, may occasionally produce gas in dextrose. This worker found that true *B. dysenteriæ* Schmitz (as opposed to these similar strains) is not clumped in Michaelis' acid media. A high titre serum was readily produced, living organisms being more easily agglutinated than dead cultures.

Stutzer (1923) isolated, from an outbreak of dysentery in East Prussia in 1917, an organism which he named *B. paradysenteriæ X*, which is apparently identical with Schmitz bacillus.

Kruse entertained no doubt as to the claims of this organism and it has been adopted as strain J in his classification. Sartorius (1929 and 1930) confirms that *B. dysenteriæ* Schmitz and Kruse J. are one and the same organism.

Perry and Bensted (1929) report the occurrence of this organism in cases of dysentery in Egypt, having isolated it nine times from adult cases (6·9 per cent of the total) and five times from children (1 per cent).

Riding (1930) describes two cases of acute bacillary dysentery caused by *B. para-Shiga* (indol +) which occurred in Sudanese natives.

The rôle of *B. dysenteriæ* Schmitz in the ætiology of dysentery has not, however, been universally accepted. Thus Andrewes, having described *B. ambiguus*[1] concludes that the organism can be rejected as having no connection with dysentery. This conclusion is reached largely because of the fact that the bacillus clumps when subjected to the Michaelis "acid agglutination" test. It is interesting to note that Murray applies this argument the other way round, and concludes that as *B. dysenteriæ* Schmitz is agglutinated by Michaelis' acid agglutination, the latter test is of no value in distinguishing pathogenic from non-pathogenic dysentery bacilli. It may be remarked that in working with the "Flexner" type of

[1] There is, however, no serological evidence that *B. ambiguus* and *B. dysenteriæ* Schmitz are identical.

dysentery bacilli, the writer has on two occasions made use of Michaelis' test and has reached the same conclusion as Murray.

Manson-Bahr (1920) is of the opinion that organisms of this type are of doubtful ætiological significance. "Organisms giving similar biochemical reactions to these (i.e. Schmitz bacillus, *B. ambiguus*, &c.), may be isolated from true Shiga stools which have been allowed to decompose for a few hours: . . . . they may be either concomitants, the products of a stale dysentery stool, or . . . . are derived from the necrotic mucosa." It is not quite clear what the author implies by this suggestion—whether he thinks the organisms are born of this material, or whether they are present throughout in the mucosa and do not multiply until certain favourable conditions, the outcome of staleness, arise, or whether products of this necrotic material lead to fundamental mutations (as later suggested by Calalb) of normal organisms. He further gives it as his opinion that intensive investigation in cases where such organisms are found would lead to the recovery of the true (*sic*) dysentery bacillus from every case.

Calalb (1925) isolated in Roumania a number of strains which gave the biochemical reactions of *B. dysenteriæ* Schmitz, but which did not agglutinate with a serum prepared from a stock culture of that organism. Sera prepared from these strains contained, in addition to homologous agglutinins, heterologous agglutinins of relatively high titre for "Shiga," "Flexner" and "Y." It is not stated if the serum was tested against the stock strain of Schmitz. The author states that these "para-dysentery" organisms were never isolated when cultures were made in the first days of the illness; that these organisms appeared only after the disappearance of true dysentery organisms; that their antigenic properties were related to those of standard Shiga and Flexner; that the latter organism after years of artificial culture tended to produce "paradysentery" forms; and in consequence the hypothesis is advanced that paradysentery organisms are none other than modified forms of the standard types.

A review of the references which have been given can, however, leave no reasonable doubt that *B. dysenteriæ* Schmitz is an entity and is capable of causing dysentery. It has been the sole dysentery-like organism to be discovered in certain extensive outbreaks of this disease. It has been isolated by numerous skilled and reliable observers from fresh specimens in the early stages of the disease, unassociated with any pathogenic organisms, and in circumstances identical to those in which accepted dysentery bacilli are found. It has given rise to the production of homologous agglutinins in the patient's serum. It has been isolated from dysenteric lesions in a fatal case, and it has apparently given rise to a case of laboratory infection.

The case in favour of its pathogenicity is, in fact, singularly complete. Andrewes' criticism—that *B. ambiguus* (assuming this to be identical with Schmitz bacillus) is agglutinated by Michaelis' test—carries no real weight, while of the observations of Manson-Bahr and Calalb it can only

be said that they do not accord with those of other workers, including, as will be seen later, military pathologists throughout India.

CHARACTERS OF *B. DYSENTERIÆ* SCHMITZ.

B. dysenteriæ Schmitz is a typical coliform organism, Gram-negative, non-motile, and measuring about 0·5μ by 1·0-3·0μ.

It grows readily on all ordinary media.

Table I shows its biochemical reactions contrasted with those of *B. dysenteriæ* Shiga and *B. dysenteriæ* Flexner (Andrewes' types.)

TABLE I.

	Schmitz	Shiga	Flexner
Lactose	—	—	—
Glucose	Acid	Acid	Acid
Mannite	—	—	Acid
Dulcite	—	—	—
Saccharose	—	—	—
Indol	+	—	+ or —

It will be seen that Schmitz and Shiga differ from Flexner in being non-mannite fermenters, while Schmitz is to be distinguished from Shiga by the fact that it produces indol.

As determined by the agglutination test, Schmitz possesses an antigen peculiar to itself. It is not agglutinated by a high titre serum specific for any of the other dysentery organisms, neither is a serum prepared from Schmitz capable of agglutinating any of these organisms.

The agglutinogenetic properties of Schmitz are limited. Thus Dudgeon mentions that he found difficulty in preparing a high titre serum; Murray succeeded in preparing a serum of 1 : 1000 titre only, while Hirschbruch and Theim did not get a titre beyond 1 : 1600. This point is of interest in relation to Indian experiences. On the other hand Schmitz and Ornstein claim to have had no difficulty in producing a high titre serum, although they do not state the titre which was reached.

No convincing results have been obtained from animal feeding or intestinal inoculation (Dudgeon), but it has been clearly shown that the rabbit is more resistant to this organism than to *B. dysenteriæ* Shiga.

PART II—*B. DYSENTERIÆ* SCHMITZ IN INDIA.

A search of the files of the *Indian Medical Gazette*, the *Indian Journal of Medical Research*, the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, and the Reports of the Public Health Commissioner with the Government

of India from 1918 onwards fail to reveal any reference to this organism, with the possible exception of two strains recorded in a paper on jail dysentery by Cunningham and King, 1917, until it was isolated by Manifold in Poona in 1925-26.

On several occasions Manifold isolated from cases of clinical and microscopical bacillary dysentery an organism which had the morphological and biochemical reactions of *B. dysenteriæ* Schmitz, but which was not agglutinated to full titre by high titre serum specific for this organism. In spite of this, it was found that the serum of patients who had suffered from dysentery, and from whose stools this organism had been isolated, agglutinated suspensions of *B. dysenteriæ* Schmitz, but not the homologous organism.

Owing to a change of appointments the work was at this stage handed on to the writer of this article who was able to investigate the question first at Bangalore and later at Poona during the years 1929, 1930 and 1931. He was further aided by receiving cultures of organisms of this type from various military laboratories in India.

Manifold's findings were repeatedly confirmed. From time to time organisms were isolated under the most suggestive conditions from cases of clinical and microscopical bacillary dysentery which gave all the biochemical reactions of *B. dysenteriæ* Schmitz, but which failed to agglutinate, or at best agglutinated only to a small fraction of the titre, with serum prepared from that organism.

TABLE II.

Sera	Suspensions	
	Schmitz	214
Schmitz	1,000	Nil
214	5,000	500

In confirmation two further cultures of *B. dysenteriæ* Schmitz were obtained through Major H. J. Bensted, M.C., R.A.M.C. One (*B. dysenteriæ* Schmitz-Hawkins strain) was from the National Collection of Type Cultures, the other being the strain maintained at the Royal Army Medical College. Both proved to be identical with the strain of *B. dysenteriæ* Schmitz maintained by the Enteric Laboratory, Kasauli, from which high titre serum for India was prepared.

To continue the investigation a strain of the Indian Schmitz-like organism isolated during the early stages of a typical case of dysentery was selected. This strain will hereafter be called by its laboratory index number "214." A rabbit was inoculated intravenously with a killed suspension of "214" and in due course a serum was produced which, when tested, gave the results shown in Table II.

The results obtained with stock high titre Schmitz serum are shown as a control.

Many different sera have now been prepared from "214" and allied strains and on every occasion results of a similar nature have been obtained, i.e. "214" serum has agglutinated a suspension of *B. dysenteriæ* Schmitz to a titre from four to ten times higher than that to which it agglutinated its homologous organism.

Table III shows the results of four cross absorption tests, carried out at different times and with different sera.

TABLE III.

Sera	Suspensions							
	1st test		2nd test		3rd test[1]		4th test[2]	
	Schmitz	214	Schmitz	214	Schmitz	214	Schmitz	214
Schmitz control..			500	25	5,000	Nil	5,000	125
Schmitz abs. Schmitz			Nil	Nil			Nil	Nil
Schmitz abs. 214			195	Nil	25	Nil	250	Nil
214 control	1,000	125	500	125	5,000	250	5,000	500
214 abs. Schmitz	25	Nil	Nil	Nil	Nil	Nil	Nil	250
214 abs. 214	125	Nil	Nil	Nil			250	Nil

[1] Carried out by Major C. D. M. Buckley, M.C., R.A.M.C., at the Enteric Laboratory, Kasauli, in November, 1932.

[2] Carried out by Jemadar Jaswant Rai, under the direction of Lieutenant-Colonel R. F. Bridges at the Enteric Laboratory, Kasauli, in October and November, 1934.

When it is recalled that at the time this investigation was started *B. dysenteriæ* Schmitz had been maintained in artificial culture for over thirteen years, and that "214" was freshly isolated, a very likely explanation of these results suggests itself.

It is well known that *B. dysenteriæ* Sonne begins, in many cases almost as soon as it is isolated, to produce "rough" variants. A serum prepared from a recently isolated, unselected culture will agglutinate both smooth and rough forms, while a serum from a selected rough colony will agglutinate only a suspension of rough organisms. The explanation of this appears to be that the smooth and rough forms have different antigens; both are present in the unselected culture, whereas in the selected rough culture only the rough antigen is present. The agglutinogenetic properties of the smooth variant are feeble in comparison with those of the rough.

The position of "214" and Schmitz, although not identical, is probably

analogous. "214" over a period of four years, has shown no tendency to form "rough" variants, but it seems, nevertheless, highly probable that the strain now known as *B. dysenteriæ* Schmitz (and maintained by the National Collection of Type Cultures) is a variant which has developed from the strain originally isolated.

Assuming this hypothesis to be correct, "214" would appear to contain two antigens, one of which (probably corresponding to the smooth antigen of Sonne) is of poor agglutinogenetic properties, and may be called "A"; the other of powerful agglutinogenetic properties, and presumably analogous to the rough antigen of Sonne, may be called "B"; "A" probably predominates and "B" is present to a much lesser extent.

As regards Schmitz (stock strain) the position is not quite clear. It will be noted that there is a striking difference between the first three and the fourth absorption tests in the results of "214" serum absorbed by Schmitz. In the first three tests all agglutinins for "214" were removed, while in the fourth test 50 per cent remained. This would suggest that at the time the first three tests were carried out, Schmitz contained a certain proportion of "A" antigen and a preponderance of "B," whereas when the fourth test was carried out it had lost most of its "A" antigen and contained only "B." This point requires further investigation, which the writer is not at present in a position to carry out.

An apparent anomaly is the failure of "214" to absorb completely from its homologous serum all agglutinins for Schmitz, despite the exhibition of very massive doses of the organism. Nevertheless it appears most probable that inadequate absorption is the explanation.

An alternative, but on the whole less likely explanation is that no such change as is suggested has taken place in *B. dysenteriæ* Schmitz (Hawkin's strain), but that this organism is represented in India by an allied strain with a different antigenic composition. Had even one strain with the antigenic characters of *B. dysenteriæ* Schmitz (Hawkin's strain) been isolated in India, this possibility would gain enormously in weight. On the other hand, the fact that, so far as can be ascertained, *no* such strain has been found renders the hypothesis unlikely.

With "214" serum as a starting point, an investigation was made of all strains of Schmitz-like bacilli which came to hand until the writer left Poona. In all, 55 strains were tested. Of these, 3 were discarded on the ground that they produced acid in saccharose (vide *B. fallax* of Ornstein). Of the remaining 52, 41 agglutinated to titre with "214" serum, while 11 were inagglutinable either with "214" or any other serum. Of the 41 agglutinable strains, 5 showed agglutination to about 5 per cent of titre with a serum prepared from *B. dysenteriæ* Schmitz; the remainder were inagglutinable with this serum.

Twenty-seven of the forty-one strains (all of the "214" type) were isolated by the writer in Bangalore and Poona. All twenty-seven were recovered from the stools of cases of clinical bacillary dysentery under the

same circumstances as are the accepted dysentery bacilli. In certain of the cases in which specimens were received at an early stage, the organism was found in approximately pure culture in plates made from washed exudate. It became more difficult to isolate as the cases advanced and was not recovered when the stools became free from obvious mucus. No other pathogenic organism capable of explaining the symptoms was found in the stools of these cases. On no occasion in Bangalore or Poona was the organism isolated except from cases presenting clinical symptoms of bacillary dysentery, despite the fact that in this period some 3,000 platings from apparently normal stools were examined. Two strains of the organism said to have been isolated from normal stools, were, however, forwarded for investigation by another laboratory.

It was possible to carry out agglutination tests with the serum of only five of these cases. None agglutinated the homologous organism. As suggested by Manifold these sera were also tested against suspensions of *B. dysenteriæ* Schmitz. Two agglutinated this organism in dilutions of 1 : 250, one in 1 : 125, one in 1 : 50, and one was negative. These results (higher agglutination of Schmitz than of "214") are analogous to those produced in the immunization of a rabbit with this organism.

The type of case from which "214" was isolated varied from mild to moderate. One severe case was reported.

Practical Application of these Observations.

As it is clear from these observations that high titre serum prepared from the stock strain of *B. dysenteriæ* Schmitz is of little assistance in identifying the strain which occurs in India, a serum prepared from "214" is being issued in lieu thereof. This allows the strain, believed to represent *B. dysenteriæ* Schmitz, to be definitely identified by serological as well as by biochemical methods, and permits of the ready recognition of other strains, similar biochemically but of different antigenic composition, which are being made the subject of special investigation.

Organisms having the biochemical reactions of *B. dysenteriæ* Schmitz and presumably chiefly "214" are widely distributed throughout India: 206 cases of dysentery were attributed to organisms of this type in 1932-33, while in the same period the number from which Shiga was recovered was 637.

PART III.—OTHER NON-MANNITE-FERMENTING BACILLI (EXCLUSIVE OF *B. DYSENTERIÆ* SHIGA).

In order to show clearly the present position as far as India is concerned, it is thought advisable to make brief reference to other non-mannite fermenting dysentery-like bacilli (other than Shiga) which are being found. For fuller details reference should be made to a recent paper by Large (1934), who is carrying out an investigation of these organisms.

Three non-indol producing strains are occasionally found. Two have

the exact biochemical reaction of *B. dysenteriæ* Shiga, but are not agglutinated by a Shiga high titre serum, nor do they show cross-agglutination against each other. These have the morphological and biochemical reactions of the organism named *B. para-Shiga* by Dudgeon.

The other differs from Shiga in that it produces acid in dulcite. It was first described by Archer (1933) from Wellington, and has since been found in Quetta.

One other indol producing strain is of not uncommon occurrence. It is biochemically identical with Schmitz and "214," but has a completely different antigen. It has been described by Large (1934), and probably accounts for some at least of the eleven inagglutinable strains mentioned above.

These four strains have occurred in association with cases which are clinically dysentery. The question of their pathogenicity is under further investigation, but is difficult to decide owing to their scarcity.

Saccharose-fermenting, indol-positive strains (probably identical with Ornstein's *B. fallax*) are occasionally found in normal stools unassociated with symptoms of dysentery.

Summary and Conclusions.

(1) *B. dysenteriæ* Schmitz is believed to be capable of causing typical acute bacillary dysentery.

(2) An organism closely allied to *B. dysenteriæ* Schmitz (Hawkins strain) is commonly associated with bacillary dysentery in India.

(3) It is considered possible that this organism represents the original phase of *B. dysenteriæ* Schmitz, and that the stock strains [*B. dysenteriæ* Schmitz (Hawkins strain) and the strains maintained at the Royal Army Medical College and the Enteric Laboratory, Kasauli] have, in the course of prolonged artificial life, undergone mutation.

(4) The substitution for *B. dysenteriæ* Schmitz high titre serum of a serum prepared from strain "214" has facilitated the identification of the organism, which is widespread throughout India.

(5) In addition to *B. dysenteriæ* Shiga and *B. dysenteriæ* Schmitz "214," other non-mannite fermenting dysentery-like bacilli have been identified in India. The pathogenicity of these strains is still under investigation.

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CYSTICERCOSIS (*TÆNIA SOLIUM*).

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(*Continued from p.* 234.)

VI.—Geographical Distribution.

England.—Human cysticercosis, like pig measles, has for its geographical distribution those countries where *Tænia solium* is found. With the advance of sanitation, meat inspection, and more hygienic methods of pig rearing, the incidence of the disease is rapidly diminishing in civilized countries. In England, the disease has never been common and is now practically unknown. English medical literature in the past hundred years shows very few cases compared with that of foreign countries. We have only been able to find forty cases of proved cysticercosis which were presumably infested in Great Britain. From 1892 to 1934 there has not been a single indigenous case reported in English medical literature, though two such cases appear in our series.

The Ministry of Agriculture state that there has been no recorded instance of *Cysticercus cellulosæ* in pigs in England for the last ten years. In the City of London, Dunlop Young reports that only two cases have been recorded in the last twenty years ; one carcase came from France and one from Ireland. Reports obtained from other large cities in Great Britain all agree that no carcase has been seized for cysticercosis in the last twelve to twenty years. Colonel Mac Arthur, however, informs us that a carcase was condemned in an English city as late as March, 1934, and destroyed as a case of trichinosis ; the diagnosis was made by a naked-eye examination, the cysts were numerous and easily visible and the case was in fact certainly one of generalized cysticercosis. The appearance of a carcase of this kind riddled with cysts and thought to be trichinosis leads one to suppose that possibly others containing perhaps only a few cysts may easily have been missed and that the reports that " measly pork " is now practically unknown in England may not be entirely justified. Ostertag states that Kern found one living parasite in the liver of a pig otherwise free from cysticerci. He states that *Cysticercus cellulosæ* is found chiefly in the abdominal muscles, the diaphragm, the lumbar muscles, the tongue, heart, masseter, intercostal and cervical muscles, the adductor muscle of the thigh and the pectoral muscles.

The museum of the Royal College of Surgeons, London, possesses one specimen of human cysticercosis affecting the brain, gastrocnæmius and heart of an Indian. This specimen was sent home by an officer serving abroad. There is no specimen of *Tænia solium* in the museum. Inquiries at three of the leading neurological hospitals in London produced only one case diagnosed cysticercosis in the past twenty-five years, though others have been diagnosed recently since interest in this condition has been revived.

Scotland.—The disease was common in pigs in Scotland thirty years ago. Inquiries made at Glasgow, Aberdeen and Edinburgh, show that no cases have been reported there for ten to fifteen years.

Ireland.—In many monographs on the subject, it is stated that the disease is common in Ireland. This may have been so in the past, but the Chief Veterinary Officers of Dublin, Cork and Belfast, assure us that no case has been recorded among pigs slaughtered in their respective towns for many years.

Germany.—In reading through the literature on cysticercosis, both in humans and pigs, one is struck by the fact that most of the reported cases are from Germany. At one time it would appear that cysticercosis in humans was extremely common. Rudolphi, in 1876, found that 2 per cent of all corpses examined at the public morgue in Berlin were infested with *Cysticercus cellulosæ*. In 1876, 3·33 per cent of all the pigs sent for slaughter in Prussia were found to be infested (Vosgien, 1911). In 1904 it is reported that 0·25 per cent of all pigs sent for slaughter were infected. Professor Ostertag of Tubingen has kindly supplied the most recent figures as regards cysticercosis in pigs for the whole of Germany:—

1930: Heavily infested pigs, 0·004 per cent; mildly infested pigs, 0·005 per cent.

1931: Heavily infested pigs, 0·001 per cent; mildly infested pigs, 0·01 per cent.

Cases of human cysticercosis are still being reported from Germany, but the number has fallen considerably. There has been no change in the habits of the German people as regards their preference for underdone pork, but sanitation, better meat inspection, and better methods of rearing pigs have reduced the incidence of *Tænia solium* to negligible proportions.

France.—The disease both in humans and pigs is now very rare. In the past it was comparatively common, though never so common as in Germany. According to Brumpt (1927), it was at one time common in Limoges, Perigord, Auvergne and Bretagne. However, in France, as in other civilized countries, the incidence has been reduced to proportions which have made the report of a case of cysticercosis a medical rarity. Doctor Chrétien, the Chief Veterinary Inspector of Paris, has kindly furnished the pre-war and post-war statistics. In Paris, in 1910, 0·34 per cent of all pigs slaughtered were found to be infested. In 1932, out of 923,398 pigs slaughtered, only ten were found to be infested. Professor

Brumpt (Paris) states in a letter dated November 6, 1933, that for the past thirty years he has not heard of a single case of *Tænia solium* in France, and that he has only rarely heard of any case of cerebral cysticercosis. It is understood, however, that in certain parts of Brittany where sanitation is not good cases of *Tænia solium* infestation are still found. Schmitte, in his thesis, "Les Cysticercosis du Nevraxe," 1928, states that he tried for a year in Paris to find a living cyst in pigs, and only found one.

Austria Hungary.—In 1904, 3·44 per cent of all pigs slaughtered were found to be infected.

Lithuania.—In 1930, 19·7 per cent of pigs imported from Lithuania to Frankfort-on-Main were found to be measled (*Periodical for Meat and Milk Hygiene*, vol. x, 1930).

United States of America.—The disease in America is very rare. The Chief of the Bureau of Animal Industry, United States Department of Agriculture, sends us the following information with reference to the present incidence of measles in pigs. "Cysticercosis is comparatively rare in hogs in the U.S.A. Since 1922 only twenty-one hogs were found infected out of the 48,850,000 slaughtered under federal supervision."

South Africa.—The disease is very common among the Zulus. Colonel Irvine Smith, Director of the City of Johannesburg Abattoir, has kindly furnished the statistics for pigs during the past nine years for that city:—

1924-25 : Pigs infected 6·02 per cent.
1929-30 : Pigs infected 4·36 per cent.
1932-33 : Pigs infected 3·22 per cent.

Houston, in a memoranda on cysticercosis in pigs, published by the Rhodesian Government in 1932, states that cysticercosis is the most common disease among pigs in Rhodesia and, curiously enough, the pigs do not appear to be noticeably affected in health. Several of the sufferers from cysticercosis reported in our series were infested during the South African War.

South America.—Four per cent of the total deaths in one of the large hospitals in Brazil were caused by cysticercosis, Pereira (1905). At the public abattoir at St. Paul's, Brazil, between 1908 and 1913, 1·8 per cent of pigs were found to be infected. In the Argentine, the disease is rare. Up to 1932 only eight cases had been reported.

India.—It has been generally understood up to the time of the present investigation, that owing to the religious customs of the inhabitants *Tænia solium* infestations are very rare in India. The vast majority of Indians belong either to the Hindoo or Mahomedan faith; both of these Religions expressly forbid the use of pork as a food. Inquiries regarding the incidence of cysticercosis at the Department of Public Health at Simla have proved fruitless. There are no statistics available for *Tænia solium* infestation in humans or pigs. Lieutenant-Colonel Taylor, Director of the Central Research Institute at Kasauli states that he has never seen a case

of *Tænia solium* infestation in the natives of India, and that he is satisfied there is no general incidence of the disease.

In the helminthological surveys of India, *Tænia solium* rarely appears in the figures. The School of Tropical Medicine at Calcutta is unable to give any information as regards *Tænia solium* in India. A search through the files of the *Indian Medical Gazette* reveals very few cases.

Campbell and Thomson reported one case of cysticercosis in 1912 and stated it was only the fourth case ever reported in India. Forsyth reported one case in an Indian shepherd at Madras, in which the brain contained numerous cysts of *Cysticercus cellulosæ*, and the intestine contained *Tænia saginata*. Nevertheless, there are millions of Indians who eat pork; including many castes such as Sikhs, Rajputs, Gurkhas, Indian Christians and a great number of non-orthodox Hindus, Untouchables, and aboriginal tribes.

Lieutenant-Colonel Knowles, Director of the Calcutta School of Tropical Medicine, writes that in Assam, every set of coolie lines swarms with pigs and that they are in droves in rural Bengal. Europeans, including British troops, also eat pork. That sold to British troops is usually purchased at the canteens in barracks, for as a rule pork is never on sale in the native bazaars. Among British troops, beef tapeworm is common, from 1928 to 1932 at Poona, one of us (H. B. F. D.) treated fifty cases of infestation with *Tænia saginata*, but only one case of *Tænia solium*.

Colonel Amy has sent the only available records for the incidence of tapeworm in India; the incidence among the British troops is as follows :—

1927	180 cases	Lahore	13
		Meerut	10
		Cawnpore	11
		Poona	21
1928	115 cases	Dagshai	10
		Lahore	19
		Jhansi	13
1929	131 cases	Poona	11
		Bangalore	14
1930	122 cases	Rawalpindi	11
		Poona	10
1932	169 cases	Poona	23
		Kamptee	10
		Allahabad	12

Unfortunately the figures do not state whether the tapeworm was *Tænia solium* or *Tænia saginata*.

In spite of the lack of information in regard to the incidence of *Tænia solium* infestations in India, out of the number recorded in this series at least sixty were almost certainly infested in India with cysticercosis. Most of the patients had served in the north of India. Places like Allahabad, Ferozepore, Lahore and Meerut figure largely among the stations at which positive cases had served. Statistics in regard to the civilian population are notoriously inaccurate, and it is felt that if a careful search were made, many more cases would be recorded both of *Tænia solium* and of cysticercosis. From what one knows of sanitary conditions and meat

inspection in India, one would expect tæniasis to be much more prevalent than is at present indicated by the Indian authorities.

It is interesting to note that three of the cases in this series were infested at Cawnpore in 1927, where there were eleven cases of tapeworm during that year. One of the patients had a *Tænia solium*, as had also the husband of another patient.

China.—In China where one would suppose the conditions were most favourable for the development of *Tænia solium* and cysticercosis, both human and porcine, the disease is apparently rare. Cysticercosis in pigs is unknown among the native butchers. Mills, 1924, states that up to that date no cases of *Tænia solium* had been treated in the Peking University Medical College. Kahn and Frager, 1930, state that up to then only three cases of *Cysticercus cellulosæ* in man had been treated in China, and that during ten years in the Peking Medical College only five cases of *Tænia solium* had been seen.

The explanation of this is probably due to the fact that although pork is a favourite dish in China, and although the pigs run about in the houses and eat all the garbage, where the sanitary conditions are notoriously defective and where there is no meat inspection, the Chinese like their pork well cooked and thus the cycle of development is broken.

Philippine Islands.—In the Philippine Islands from 1907 to 1926, in 12,000 autopsies only two cases of *Cysticercus cellulosæ* were seen. Africa and Cruz (1927) state that up to 1927 only 5 cases of human cysticercosis had been recorded. This, curiously enough, despite the fact that 1 in 91 of all pigs slaughtered were infested.

Singapore.—Tull and Subrahmanyam (1934) give the following figures from Singapore, where two-thirds of the population are Chinese. Very careful meat inspection is carried out and of 894,316 carcases of pigs examined in the past four years, 3,630 were condemned for cysticercosis. Of 118,723 patients admitted to Tan Tock Seng Hospital during the last nine years, only six patients have been found harbouring *Tænia solium*; all patients have their stools examined for worms or ova. Of 1,178 complete autopsies performed during the past four years only one case of cysticercosis has been found.

VII.—Age, Sex, Occupation.

(*a*) *Age Incidence*.

Although from our knowledge of the pathology of the disease no age should be exempt from cysticercosis, yet all observers agree that its maximum age incidence is in adult life. This fact is very important, as the condition which it frequently resembles, i.e. idiopathic epilepsy, is a disease with an onset predominantly in childhood and adolescence. Gowers, quoted by Price (1933), found among 1,450 cases of idiopathic epilepsy that one-third commenced before the age of 10 and three-quarters before the age of 20. In the 56 cases of cerebral cysticercosis collected by

Griesinger in 1862, the average age incidence was between 30 and 40. Sato's statistics quoted by Oppenheim show that cysticercosis is most common between the ages of 40 and 60. Volovatz (1902) found that out of 447 cases, 209 were between the ages of 20 and 40. Dressel's series, quoted by Leuckhart, show that 39 out of 74 cases were in the prime of life at the onset of the disease. The age incidence corresponds to the age incidence of infestation with *Tænia solium*. It is a curious fact that experiments on pigs have shown that only young pigs can be infested. That children are not entirely exempt from infection is proved by the first reported case of a cysticercus in the eye, which occurred in Great Britain in a child aged 7 (Logan, 1838). Three of the cases in our series are children, two twins, aged 13 (reported by Morrison), one of whom had a tapeworm but no fits, the other had fits but no tapeworm, and one boy aged 10. All three cases show calcified cysticerci radiologically. In the literature, Dressel 1877, Virchow 1877, quoted by Leuckhart, there are several cases reported of children a few days old, 6 months and 1 year, who had been infected presumably in utero, as cysticerci had been found in the placenta. In each case the mother had a tapeworm. In the present series, the age incidence is definitely lower than that of older observers, the youngest being the child of 10 referred to above, and the oldest being 39 years of age at the onset of the first symptoms. This may be due to better facilities for observation and questioning as to the date of the first fit or the appearance of the first subcutaneous nodule, and to the fact that all cases except five were diagnosed while the patient was alive; whereas previous statistics include many cases diagnosed post mortem. Volovatz has called attention to the curious fact that there appears to be some connection between age and localization of the cysticerci. She states that in children the disease has been most frequently observed in the eye, and the only cases where cysticerci have been found in the lungs have also been in children from 1 to 10 years of age.

(*b*) *Sex Incidence.*

If we accept accidental contamination of food and water as the most common cause of the disease, there does not appear to be any reason why females should be exempt from cysticercosis. The fact however remains that the majority of published cases have been in males. Since 1892 only two cases in females have been published in England and they were the wives of soldiers and had lived in India. Occupation is intimately linked with the sex incidence; by virtue of it women are less likely to be exposed to infestation in parts of the world where sanitary conditions are bad. Their living conditions are, as a rule, much better and they can more easily perform the necessary ablutions before eating. Other writers have found the same sex incidence. Waterhouse (1915) out of seventeen cases found four to be females. Leuckhart, in 1886, commented on the fact that although *Tænia solium* was more common in females, yet cysticercosis was

more common among males. Infection can reasonably be expected more often in men whose work is out of doors. Of our cases only the two mentioned above were females.

(c) Occupation.

According to most authorities the mode of life and occupation have a very important ætiological influence. Cysticercosis is said to be a disease of the poor, of individuals careless of their personal hygiene or those who live in bad hygienic surroundings.

The present investigation was carried out at a Military Hospital and the patients included only soldiers and their wives and children. There is no reason why persons in other walks of life should not suffer from cysticercosis; the fact remains that we have been unable to trace any published case in England since 1892 that was not a sailor, soldier or a soldier's wife or child. Volovatz noted that the disease was common among the French colonial troops. It is soldiers that form the bulk of patients of the hospital class returning to England from abroad, they travel to many parts of the world where sanitation is bad, and live a communal life particularly favourable to the spread of an infection carried by flies or on the hands or clothing of one uncleanly member. As regards one of our patients the husband noticed that he had a tapeworm in May, 1927; his wife developed fits three months later and eventually died in an asylum from mania caused by cysticercosis. We also have a record of five patients from the same battalion all with nervous symptoms, two of whom are proved cases of cysticercosis each having had a tapeworm, the three others being under suspicion. These men all served together in India. It is only recently that any serious attempt has been made to investigate possible cases and up to the present time this has been done almost exclusively in the Army; it is quite possible that there are many undiagnosed civilian cysticercosis patients in England at the present time. An analysis of our cases does not show any particular military occupation in which cysticercosis is more likely to be contracted than another. Only one of our patients was employed as a sanitary orderly. Curiously enough, six patients were employed in the band.

(*To be continued.*)

THE PROBLEM OF CHRONIC FRONTO-ETHMOIDITIS.

By Major C. A. HUTCHINSON,
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(*Continued from p.* 242.)

Fraser and Stewart [7] favour Coakley's modification of the Killian operation, which consists of opening the frontal sinus through its anterior wall, and entering the ethmoidal region through its lateral wall in the region of the inner canthus, leaving a bridge of bone between the upper and lower openings.

This operation has, however, been abandoned by the majority of rhinologists, not so much on account of the resultant disfigurement (particularly if necrosis of the "bridge" occurs), as because of the serious risk of spread of infection into the diploë of the cranial bones, with the production of diffuse osteomyelitis and intracranial complications, or pyæmia. There is, moreover, the possibility of some pathological mucous membrane being left behind in the "blind area" created by the bridge, which may give rise to subsequent trouble. It is, nevertheless, the operation of election when intracranial complications are already present.

The remaining external operation is the Howarth, which enables the most radical removal of the mucous membrane to be carried out, or more conservative measures to be adopted; it has the additional advantage of leaving no "blind area", and lastly, being carried out through the floor of the sinus, which consists of compact bone, there is distinctly less risk of ensuing diffuse osteomyelitis than when an entry is made through the anterior sinus wall.

The Howarth Operation.—This operation is being described in detail as the author has found the following technique satisfactory even under Indian conditions.

After careful preparation of the skin on four consecutive days, as a preliminary to operation on the fifth day, the anterior nares are swabbed out with 75 per cent spirit, and the nasal cavity of the affected side is packed with a long strip of gauze soaked in equal parts of 10 per cent cocaine and 1 : 1,000 adrenalin half an hour before operation.

It is essential that good radiograms be available in the theatre throughout operation. The operation is performed under intratracheal anæsthesia, chloroform-ether mixture being preferred; and the nasopharynx is well packed off.

Two radiating scratches are made to assist subsequent accurate closure. The skin is then drawn upwards, and a curved incision made from a point a little internal to the supraorbital notch to another point opposite or a little below the inner canthus.

Before proceeding further all hæmorrhage must be completely arrested; particularly that coming from the angular vessels, which is apt to be most troublesome. It is best to ligate all bleeding points at once.

The periosteum is then divided in the line of the skin incision, and the orbital periosteum raised intact by working against the bone, carrying with it the attachment of the pulley of the superior oblique muscle. This periosteal raising is carried as far back as is considered necessary for the case in hand.

The raised periosteum, carrying with it the orbital contents, is then held out of the way by a flat retractor in the handling of which extreme gentleness is necessary.

With gouge and mallet the frontal sinus is then opened through its floor. Unless the mucosa is obviously healthy, the floor is then removed with bone forceps as far as the lateral limit of the cavity; all loculi being carefully examined and any atypical extensions of the sinus opened up.

All pathological mucosa is removed, great care being taken not to nick the bone in so doing, while all mucous membrane which appears to be capable of recovery is carefully preserved.

The packing is now withdrawn from the nose. With bone forceps or gouge and mallet the fronto-nasal duct is next opened up and the medial bony wall of the orbit removed with bone forceps as far back as is judged expedient. The cells of the ethmoidal labyrinth are now freely accessible, and, as there will be found to be very little bleeding, can be exenterated with cutting forceps under direct vision; the vertical plate of the middle turbinate being carefully preserved to safeguard the olfactory area.

When all pathological material has been removed, the cavity is swabbed out successively with peroxide, spirits and Bipp, and finally packed with a paraffined gauze strip brought out through the nares, this packing being removed on the morning after operation.

The orbital periosteum is then replaced and accurately fixed in position with a mattress suture.

Finally the skin wound is stitched, preferably with a subcuticular suture, the scar becoming almost invisible in a few months.

Difficulty may sometimes be experienced in keeping the fronto-nasal channel from closing too much during healing; the avoidance of irrigation for two to three weeks after operation will help to prevent this. The after-treatment preferred by the author is the institution of four-hourly menthol inhalations after the removal of the packing, keeping the nose clear of secretion by swabbing it out, and daily spraying of the nasal cavity with ¼ per cent phenol in paroleine.

The use of drainage tubes and silver nitrate is not recommended as a means of preventing overclosure. Should it occur, the use of a rasp with or without subsequent bouginage will produce the desired result in the majority of cases.

A refinement of the Howarth operation, to lessen the risk of overclosure,

is to Thiersch-graft the fronto-nasal channel. This is popular with some authorities.

It may be mentioned here that it is advisable to remove the antero-inferior part of the middle turbinate as a preliminary to the above operation in cases where this structure is noticed to be hypertrophied.

(*e*) *When the posterior ethmoidal cells are alone involved*, Howarth's operation with conservative treatment of the frontal sinus is the method of choice.

Persistence of Pain in Spite of Established Free Drainage.

This may be due to at least two causes:—

(1) Loculation with improper drainage of the loculus.

(2) A hypersensitive condition of the inflamed mucous membrane in a patient whose deep trigeminal nuclei are also hypersensitive as the result of a mild toxemia arising from the sinus or some other septic focus.

Persistence of Discharge after Operative Treatment.

Logan Turner and Goldsmith of Toronto [8] deprecate attaching too much weight to the presence of a little mucoid or mucopurulent secretion from the labyrinth or, especially, from the frontal sinus. They also point out that the presence of lymphocytes and polymorphonuclear leucocytes in washings from the frontal sinus merely indicates chronicity, and does not of itself demand further operative treatment.

A neurotic patient should be treated along common-sense lines; regulation of the manner of living, diet, habits and exercise being of more importance than local medication.

It may occasionally, however, be necessary to do something, and then it is advisable to select something simple and inexpensive.

Failure to cure fronto-ethmoidal suppuration may be due to:—

(1) Insufficient removal of pathological frontal mucous membrane.

(2) Incomplete treatment of an infected ethmoid; especially failure to clear out all the infected outlying ethmoidal cells about the floor of the frontal sinus and the roof of the orbit.

(3) Failure to secure adequate permanent drainage into the nose, either the result of excessive post-operative closure, high septal deflection, large middle turbinate, or hypertrophied anterior lip of the infundibulum.

(4) Failure to recognize and treat co-extant suppuration in a large crista galli cell or in the opposite frontal sinus.

(5) Failure to secure arrest of all hæmorrhage at operation, and consequent inability to see properly and to open thoroughly every recess and cell into the main channel.

(6) Excessive and injudicious lavage interfering with the healing process after a well-conducted operation.

(7) The existence of syphilis, tubercular infection, malignant disease, foreign body, or sequestrum.

Treatment.

A. In the absence of pain and œdema of the forehead or bulging of the lower wall, the effect of dry heat and irrigation with the frontal cannula should be tried.

B. If the frontal sinus is of very large size with many loculi, and persistence of discharge is the main complaint, the question of the wisdom of further operation should be seriously considered on account of the certainty of producing considerable scarring. Transnasal ionization should be given a trial.

C. If the symptoms and signs mentioned above are present, and X-rays reveal considerable ethmoidal disease alone, further ethmoidal removal is indicated by Mosher's or Sluder's method. But if the frontal sinus is also involved, if polypi recur high up in the nasal cavity, or if there be an orbital extension of the ethmoidal cells nothing short of radical operation will cure the condition.

It is anatomically impossible to remove all ethmoidal cells by the transnasal route: some authorities, however, recommend that this be adopted, and recommend that it be done in stages, allowing time for the subsidence of inflammatory œdema between each stage.

After an apparently thorough ethmoidal toilet, a full month's wait with occasional lavage allows results to be judged. If suppuration persists, there may still be cells which have been overlooked; but it is also necessary to eliminate inflammation in one of the larger paranasal sinuses as influencing the ethmoidal condition.

If further operative treatment is thought advisable, external operation is the best, and a Howarth should be performed. Its performance is not free from danger as there may be scarring and obliteration of land-marks. Even a moderately deflected septum should first be resected to give as much room as possible. It can be satisfactorily performed even if there be a fistula; but of course if there be any necrosis of a previous "bridge," bad scarring must be expected.

In combination with operative measures, irrigation with argyrol or neosilvol may help, but too strong silver salts should be avoided. Bismuth and oil may sometimes be of value in more recent cases, but there is a tendency for it to cake and remain indefinitely. Zinc ionization is likely to be most useful.

Repeated lavage during after-treatment is to be deprecated, there being a distinct risk of spreading the infection, while no benefit is derived from it. Hawking, mopping out, and gentle blowing of the nose, with forceps removal of crusts are better; final spraying with an oily antiseptic prevents drying and keeps everything sweet.

Radium may be of service, and a cautious trial is justifiable in the treatment of resistant cases with repeatedly recurrent polypi. A relatively large dose should be given with light screening for a short time. A

vigorous local reaction is produced, but after a few months the local condition may be much improved.

Constitutional treatment.—The constitutional disturbance varies considerably. Vaccines are of very little use. Anything improving the general health may help. Further operation is not to be embarked on lightly, but time must be allowed to elapse before the results are judged. Provided reasonable drainage exists, headaches, if present, are probably due to neurasthenia.

DETAILS OF CERTAIN CASES TREATED BY HOWARTH'S OPERATION.

(1) I. Kh., male, aged 49. Many years history of nasal polypi, nasal obstruction, headaches, fœtor of breath, pyorrhœa, etc. Intranasal examination showed the presence of multiple polypi in both nostrils, bathed in purulent secretion. Trans-illumination showed that both antra and frontal sinuses did not light up. X-ray showed both antra, frontal sinuses, and anterior and posterior ethmoidal cells on both sides to be opaque.

Howarth operation performed on the right side May 9, 1933. Multiple polypi were removed, thickened frontal mucosa was removed, and necrotic purulent ethmoidal cells exenterated. Healed by second intention, as a small sinus formed in the middle of the scar. This was curretted and stitched when immediate healing ensued. Patient's health improved.

Howarth operation on the left side August 14, 1933. Polypoidal mucosa of frontal sinus removed, after removal of many polypi. Purulent ethmoidal cells exenterated. Healed by first intention. Slight diplopia on looking down came on due to the development of a deep-seated granuloma; this was subsequently removed. Both antra to be treated at a later date. Nasal reaction soon subsided. Health continued to improve.

Subsequent progress : Troublesome eye symptoms gradually ensued for which the patient was eventually invalided out of the Service, when touch with him was lost.

Up till February, 1934, six months after his second operation, his condition was as follows: Some relief of symptoms; polypi reforming in right nostril, which was again discharging a purulent secretion; left nostril clear; persistent diplopia.

(2) Major S., aged 46. History of gradual onset of frontal headaches and ethmoidal discomfort over a period of some years, with steadily progressing loss of self-confidence, insomnia, inability to concentrate, and melancholia. He looked very toxic on admission, was slow in responding to questions put to him, and gave other evidence of slow cerebration. Intranasal examination suggested chronic sinusitis. X-ray showed the right frontal and right ethmoidal region to be definitely opaque, and the left antrum doubtfully so.

Howarth operation performed on the right side, June 13, 1933. Purulent contents of right frontal sinus and paraorbital air cells evacuated. Pathological frontal mucosa removed. Right ethmoidal region exenterated. Healed by first intention. Nasal reaction soon subsided.

Tonics, graduated exercise, etc., produced definite improvement in his general health and mental condition. Proof-puncture showed his left antrum to be clear.

After three months' leave, including a sea voyage, he returned to his duty a changed individual. Up till a year since operation this improvement has been maintained.

(3) Mrs. W., aged 30. Many years history of frontal headaches, nasal obstruction, post-nasal catarrh, listlessness and inability to concentrate; and three weeks history of sore throats. Intranasal examination showed a congested left inferior turbinate with pus in the left middle meatus. Trans-illumination showed nothing. X-ray showed her left frontal sinus and ethmoidal region to be opaque, and her left antrum too.

Howarth operation performed on the left side, September 18, 1933. Purulent contents of left frontal sinus evacuated. Left ethmoidal cells exenterated. Healed by first intention. Nasal reaction soon subsided.

Following plague inoculation, there was a return of the frontal headache, but on the opposite side. Headlight baths, menthol and tinct. benzoini co. inhalations produced subsidence in five days. Her condition thereafter was found to be considerably improved up till five months after operation, when she returned to the United Kingdom; this progress was maintained.

(4) Private Mc., aged 21. History of frequent head colds, morning headaches, nasal obstruction, post-nasal catarrh, etc., of long duration. He looked very toxic on admission. Intranasal examination revealed the presence of polypi and pus in upper and middle meatus of both sides. Trans-illumination showed both antra and frontal sinuses to be opaque. X-ray showed right frontal, ethmoidal region and antrum to be relatively opaque, left frontal clear, left ethmoidal region and left antrum opaque.

Howarth operation performed on the right side, September 13, 1933. Right frontal sinus cleared out of pathological mucosa and purulent contents. Right ethmoidal cells exenterated. Antra and left ethmoidal region to be dealt with at a later date.

The patient took the anæsthetic badly; but there was no undue hæmorrhage or shock. He died from sudden heart failure two hours after operation ended. The air passages were found to be clear at autopsy, and all organs apparently normal.

(5) Mrs. L., aged 43. History of headaches, nasal obstruction and post-nasal catarrh of long duration. She was in a very "nervy" state, almost to the extent of a "borderline mental" case. Intranasal examination revealed the presence of congested turbinates and pus in both middle meati. X-ray showed right frontal sinus and ethmoidal region to be relatively opaque, left frontal sinus doubtfully so, and left ethmoidal region apparently normal.

Howarth operation performed on the right side, October 21, 1933. Polypoidal frontal mucosa and seropurulent contents cleared away. Necrotic ethmoidal cells with polypoidal mucosa and purulent contents exenterated. Healed by first intention. Nasal reaction soon subsided.

Owing to my transfer to the Northern Command it was impossible to carry out any treatment on the left side of this patient's nose.

Subsequent progress: In response to inquiry, it was learnt that up till nine months since operation there has been no further trouble on the operated side, but that the patient has experienced a certain amount of headache and pain on the unoperated side and has been under treatment for rheumatism. Her general health has otherwise been a good deal better.

(6) Private L., aged 20. History of nasal obstruction on both sides, frequent head colds, headaches, post-nasal catarrh, etc. Intranasal examination revealed a moderate degree of left-sided septal deflection, congested middle and inferior turbinates on the right side, and pus in the right middle meatus. X-ray showed relative radio opacity of the right fronto-ethmoidal region.

Howarth operation performed on the right side, February 23, 1934. Thickened mucosa and purulent contents of frontal sinus cleared out. The ethmoidal cells contained pus and multiple polypi, which were all cleared out. Healed by first intention. Nasal reaction soon subsided. A great deal of œdema developed in the region of the wound and in the adjacent eyelids. This responded to fomentations and bouginage of the fronto-nasal channel, but paresis of the internal rectus muscle was subsequently found to be present. This is gradually passing off. The intranasal condition is now satisfactory (six months since operation) and the symptoms have been relieved.

(7) Sepoy N. Kh., aged 27. History of fronto-vertical headaches, chronic head colds, nasal obstruction, and post-nasal catarrh. Intranasal examination revealed congested middle and inferior turbinates on the right side, multiple polypi and much pus in the right middle meatus. X-ray showed right-sided fronto-ethmoidal radio-opacity.

Howarth operation performed on the right side, March 7, 1934. Polypoid frontal mucosa removed, ethmoidal cells exenterated. Nasal reaction soon subsided. Healed by first intention.

Up to the present (five months since operation) symptoms have been relieved, and there has been no recurrence of polypi.

(8) Mrs. S., aged 33. History of severe bilateral headaches, mainly in frontal region, worse on moving the eyes (especially to the right). The patient also complained of more or less generalized headaches over both mastoid regions and the back of her head, so a neurotic element was suspected. Chronic head colds and post-nasal catarrh were also complained of. All the above were of long duration and tending to get worse. Intranasal examination revealed congested turbinates on both sides, much pus in the left middle meatus and to a lesser extent in the right one. Multiple polypi were present in the right middle meatus. X-ray showed radio-opaque frontal sinuses and ethmoidal regions on both sides. Both mastoids were also X-rayed, but found to be clear.

Howarth operation performed on the left side, June 8, 1934. Thickened frontal mucosa was removed. Purulent ethmoidal cells were exenterated. Healed by first intention.

Howarth operation performed on the right side, June 22, 1934. Polypi removed. Anterior ethmoidal cells were not extensively involved. The posterior ethmoidal cells had polypoidal mucosa and contained pus. The entire ethmoidal labyrinth was exenterated. An extension of the anterior ethmoidal cells below the orbit had purulent contents, and was accordingly also cleared away. The frontal mucosa was also polypoidal, and the contents of this sinus were purulent. It was well cleared out. Healing took place by first intention.

The patient is still complaining of occipital headaches, but it is hoped that they will improve with a course of bromides, valerian and suggestion; particularly as her general health has considerably improved.

(9) Lance-Corporal S., aged 23. History of frontal headaches, chronic head colds, nasal obstruction, especially on the left side, and a feeling of tightness in the ethmoidal region. Intranasal examination revealed congested turbinates on the left side, and a great deal of pus in the left middle meatus. X-ray showed both anterior and posterior cell groups as well as the frontal sinus to be relatively radio-opaque.

Howarth operation performed on the left side, June 13, 1934. Polypoid frontal mucosa was removed, as were also its purulent contents. The ethmoidal cells were exenterated. Healing took place by first intention. Some œdema of the left eyelids developed; it was, however, soon dispersed by foments. It is too early as yet to form any opinion as to subsequent progress.

(10) Private H., aged 26. History of epistaxis, inability to shake off repeated head colds, nasal obstruction, left sided frontal headaches relieved by bending down, when a free discharge of fluid occurs, and by blowing the nose, and post-nasal catarrh. Intranasal examination revealed congested inferior turbinates and pus in the left middle meatus. Pressure over the floor of the frontal sinus on the left side gave rise to discomfort. X-ray showed relative radio-opacity confined to the posterior ethmoidal cells.

Howarth operation performed on the left side, June 22, 1934. Mucosa of frontal sinus was only slightly thickened, while its contents were serous, so it was disturbed as little as possible. Anterior ethmoidal cells appeared to be normal. The posterior ethmoidal cells had polypoid mucosa and purulent contents. The entire ethmoidal labyrinth was exenterated. Healing took place by first intention. Some three weeks after operation œdema of the left eyelids developed. Examination showed the fronto-nasal channel to be much obstructed by œdematous mucosa; this was cleared away and the antero-inferior part of the middle turbinate was removed; after which the œdema of the eyelids soon subsided. Up to the time of writing the nasal condition is satisfactory.

SUMMARY.

(1) Empirical treatment is to be strongly deprecated.

(2) Non-operative treatment of this somewhat intractable condition is apt to be disappointing both to the patient and to the rhinologist; partly owing to the futility of many of the methods suggested and partly because of the strictly limited applicability of and merely transient benefit given by such methods as are worthy of trial.

(3) Where the disease is quiescent the case is best left alone.

(4) Where the patient is in good health and has only slight catarrhal symptoms, the case is best treated symptomatically.

(5) The keynote to success in surgical treatment is accurate location of the diseased cells: for this good radiograms taken in standard positions are essential.

(6) When the infection is limited to the frontal sinus or to the anterior ethmoidal cell group, transnasal surgery may be adequate.

(7) When the infection is more widespread, the question becomes a more complex one.

(8) Special indications for external approach are: (*a*) Associated frontal and ethmoidal infection, when both anterior and posterior ethmoidal cells are involved; (*b*) fistula at the inner angle of the orbit communicating with the ethmoidal labyrinth; (*c*) presence of orbital cellulitis or an intracranial complication; (*d*) persistence of symptoms in spite of the establishment of efficient drainage; (*e*) when economic reasons exist for not risking exacerbations, the latter being a constant possibility as the result of more or less sudden obstruction of the fronto-nasal duct and the possibility of "break-through" into the cranial cavity, constituting a serious menace to the patient's life; (*f*) presence of a neoplasm in the sinus; (*g*) when the subject of exacerbations is about to travel beyond reach of rhinological aid.

(9) The chief desiderata for radical operations on the fronto-ethmoidal region are complete exposure of the whole interior of the sinus and free access to the infected ethmoidal cells.

(10) In the Howarth operation we have a means of approach which fulfils all requirements, leaves the olfactory "danger area" intact, and enables the surgeon to be conservative or most radical according to indications. The results obtained are distinctly encouraging.

(11) This operation can be performed with safety under Indian conditions provided adequate skin preparation is employed, and rigid asepsis practised both at operation and in the after-treatment.

(12) Rhinologists are still divided into "internists" and "externists"; but it must be borne in mind that repeated minor operations are unsatisfactory and ill-tolerated by the patient; and, since it has been conclusively shown that the risk of intracranial pyogenic disease ensuing is greater when all the infected cavities are not dealt with at one sitting, there would appear to be a very strong case for external operation which enables radical treatment to be carried out under direct vision.

I am indebted to Major-General T. G. F. Paterson, D.S.O., K.H.P., I.M.S., D.D.M.S., Northern Command, and to Lieutenant-Colonel C. D. K. Seaver, R.A.M.C., Commanding British Military Hospital, Murree, for permission to send this article for publication.

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THE DOCTOR'S WAR, 1899-1902.

By D.A.D.M.S.

(*Continued from p.* 32.)

Paardeburg was not a pleasant place. Cronje and his four thousand men, women, and children were cornered in a bend of the Modder River on their way to Bloemfontein and escape definitely blocked. You notice I use the words "women and children" as forming part of the Boer forces. It is true that Cronje had no objection to the old custom of the fighting Boer taking his wife and family, or some of them, into the firing line with him. In fact, Cronje had his own wife with him in the defensive laager he had formed with all his wagons and animals collected into a perimeter camp. He made full use of the steep banks of the Modder, digging deep in to form caves and dug-outs, and with the river on one flank and a wide open plain forming an ideal field of fire on the other, the Boers were in a strong position. But it was only a matter of time. He could be shelled out or starved out; surrender must come. But Cronje was a dour old fighting man; no doubt he treated the matter much as he would have done had he been surrounded by Zulus or Matabeles. Hadn't he often been in laager before with enemy on all sides and hadn't his men just shot them down until they got tired of being killed and went away to leave him in peace? The same thing would happen again, these Englishmen would soon get weary and march away back to Cape Town. So he told his Commandants and made ready to fight for many days and nights. And after one determined infantry advance that brought our trenches close to the laager, the battle became static, developing into a close investment and a steady shell fire from our now powerful artillery. We just sat and waited. Casualties kept dropping into the Field Hospital, a pretty steady stream of sick and wounded. We were situated down-stream from the laager and could watch the dirty waters of the Modder getting more and more foul. Swollen bodies of dead oxen drifted past, all four legs stiffly pointing skywards. All kinds of flotsam and jetsam went past, dead horses, dead men sometimes and refuse from that now indescribable laager. Conditions there must have been awful. The Boer was not a keen sanitarian at any time. His usual custom was to take his guest to the farmhouse door and pointing out the limits of the land say "Here is my beacon and there is my beacon, you can sit where you please." A large Boer population in the limited area of the laager—you can imagine the rest.

I was not to see the surrender of Cronje's Army after all. I was suddenly ordered to take over a convoy of sick and wounded and accompany them to railhead at Modder River Station. The P.M.O. (Surgeon-General Stephenson) personally put me in charge of the convoy, giving me a meal

before we started, and also a list of some small comforts he would like me to bring back from Modder Station. The Consulting Surgeon, Sir Watson Cheyne, was also present, and he made a special request for a box of ginger-nut biscuits. The convoy consisted of some 160 sick and wounded accommodated in the great heavy springless ox wagons of the country. These wagons had brought supplies and forage for the Army and were now returning empty. The South African ox wagon is a very big vehicle, very solidly built for trekking over a roadless country, has great heavy wheels, and groans and bumps solidly along. The wagon is covered over with a tent-like erection, and is in fact a travelling caravan. The motive power is provided by a team of 16 oxen yoked to a long centre pole called a disselboom. The driver of the team wields an enormous whip as big as a salmon rod and can flip a fly off the leaders ear with this formidable weapon. The drivers are all natives and always have special names for their oxen. "Deutschman" and "Englischman" were common names. To keep the long team straight a very small black boy, generally wearing a torn old vest as his one garment, walked at the head of the procession leading the first pair of oxen with a rein made of dried and stretched animal hide, called rimpi, attached to their horns. He also kept up a shrill stream of abuse or encouragement to the team.

The convoy consisted of some forty wagons. The sick and wounded were accommodated on the floors of the wagons, bad cases on stretchers lashed and fixed to the sides, and less serious cases on straw mattresses laid on the boarding. I had a wagon as a sort of medical depot supplied with some "medical comforts" in the way of bovril and brandy and a medical pannier, splints, bandages, &c. The convoy was under the orders of an R.A.S.C. Officer, and I believe we had no armed escort. Presumably we were under the protection of the Red Cross. We moved at night and marched to reach a definite stopping place each morning. We had three such halts, each time at a military point held by a garrison and containing a Field Hospital. At each halt our patients were redressed or otherwise attended to as necessary. My duties consisted in giving any attention required during the slow night marches. I was kept pretty busy; the wounded and sick men suffered from the slow heaving motion of the great wagons and yet not as much as one might expect; though springless the motion was not so much jarring as just heavy rolling of the vehicle kept in check by the supreme slowness of the pace of the oxen. I believe the recognized pace of the trek ox is one and a half to two miles an hour. The night travelling is done to suit the animals, they work better at night when it is cool; if used during the heat of the day they quickly break down.

At our first halt we had the distinction of being received in person by the Commander of the Guards Brigade, Major-General Pole-Carew. He rode out to meet us and informed me that the sight of the long convoy approaching in a cloud of dust had caused considerable alarm. Somewhat emphatically he stated that no information had reached him of our

departure from Paardeburg, and he was inclined to blame the medical authorities for not having notified him of the impending arrival of a convoy of wounded. Whoever was to blame it was hardly the duty of the Medical Staff to notify the movements of a number of returning supply wagons now being utilized to transport wounded. This little complication shows how unsuitable was the system of utilizing transport for the double purpose of bringing forward supplies and taking back wounded. Apart from the humanitarian side, and the total unsuitability of springless ox wagons serving as ambulances, the dual purpose was certain to produce complications as regards times of departures and arrivals; the wagons were suitable for carrying food for the troops but quite unfit for the needs and necessities of the sick and wounded. It was indeed a barbarous custom, which died an early death in 1914 at the birth of the motor ambulance convoy.

It was a dreary business this slow treking through the night. There wasn't very much that one could do beyond marking down the worst cases and paying them visits at intervals to readjust splints and dressings to make them more comfortable. As we were approaching the pontoon bridge over the Modder at the end of our journey we were passed by a strange cavalcade. A large country Cape cart escorted by a detachment of mounted troops drawn from the famous C.I.V.'s, the City of London's Imperial Volunteers. In the Cape cart sat General Cronje and his wife, prisoners of war, taken at the surrender of Paardeburg. I had an excellent view of the pair of them as the party slowed down to cross the pontoon bridge. The Boer General was deeply interested in the pontoons and leaned out of the vehicle to have a good look. I saw a strongly-built middle-aged man, broad in the chest and shoulders, and heavily bearded—a good bushy thick black beard, not trimmed or titivated in any way, just lying square on his chest. Strong features, rather a beaky nose, and dark eyes. He had a distinctly patriarchal biblical look. One expected him to be holding a bible in one hand, but he wasn't—he was holding an immense pipe. He wore no uniform—a loose, rough, tweed suit, and a big soft hat. Beside his commanding figure sat a small, dark, dried-up-looking woman. She was wearing a black silk dress of the period, high in the neck and puffy about the sleeves and on her head a black bonnet. An incongruous figure to have just emerged from a dug-out in the bank of a smelly river where she had suffered the hells of constant heavy shell-fire for days and nights: not to mention heat, dirt, thirst and starvation. General Cronje said something to his wife and she, too, leaned forward to have a look at how these English made bridges out of boats. The cavalcade clattered on to the bridge and the Cronjes passed on to captivity. Not a cultured pair, perhaps not very well educated, knowing little of polite society, but indomitable, courageous, steadfast, members of a fine sturdy race. I take off my hat to the memory of General and Mrs. Cronje. Now Major Charles Burtchael rode across the bridge to meet us; he was Secretary to the Principal Medical Officer of Lord Methuen's force still at Modder River and made all arrangements for the reception of my wounded.

I had a short stay at Modder but found time to have a look at the now deserted Boer position at Magersfontein. There was nothing remarkable about it. Deep trenches zigzagging along the base of the kopje, very untidy and littered with spent rifle cartridges and odds and ends of refuse. On the slopes of the kopje were many stone redoubts, dotted about in an irregular manner and seemingly built to hold small firing parties. Higher up were tracks leading to gun positions. It all looked very amateurish and haphazard; the stories we had heard of the wonderful underground defences and disappearing guns were all untrue, just sensational talk. A compound at the Modder had been prepared to receive the war prisoners from Cronje's surrendered commandos. I paid it a visit and saw many Boers of all ages. It seemed quite common for whole families to go forth to war and to stay together in the same force. As an example it is recorded in an English paper that out of 1,000 prisoners, the following names predominated in the numbers given: Pretorius, 21; Van Vuren, 23; Van Niekerk, 14; Van Rensburg's, 10; Van Der Merwes, 19; Van Zyls, 17; Botha, 14; Joubert, 13; Coetzees, 15. I spoke to a large bearded man in the compound, and he courteously introduced me to his sons and several nephews, as if I had just arrived from England to pay him a friendly visit. Remarkable to look forward a few years only to 1906, when the first visit was paid to England of the series of famous Rugby football teams from South Africa called the "Springboks" and containing players of the same names as the war prisoners of Modder River. Indeed their best player was a wonderful little stand-off half back called Kruger, a relation of the venerable Paul Kruger, President of the South African Republics. To show how casual and almost friendly was the spirit in which this war was fought I learned years after that an Englishman (who in later years attained to Cabinet rank), was actually appointed to the Boer G.H.Q. at Pretoria and allowed to send despatches to his paper in London. The man who told me was a Dutchman from the Cape who held a law appointment in the Transvaal and was himself on the staff of General Joubert, the Boer Commander-in-Chief at the commencement of the war. The Englishman in question was representing a London paper in Pretoria before war was declared. On the declaration he went to my Cape friend and said, "Look here, old boy, can you get me kept on in Pretoria as a sort of unofficial correspondent for the English papers." The Transvaal lawyer took him along to General Joubert and introduced him thus, "I have a tame Englishman here who wants to stay with us and tell his paper in London how the war is getting on, have you any objection?" The old Dutch General was quite agreeable. And so, in fact, despatches appeared in London papers headed Pretoria! This friendly arrangement did not last very long and was put an end to when men of more advanced military views, like Botha and Smuts, took over command. What a pity we could not have had a correspondent of the *Daily Post* in Berlin in August 1914 to tell us how the German army was getting on.

In the Compound was a war prisoner of great interest to us, one Major Albrecht, who was in command of Cronje's Artillery. He was a German gunner who had, I believe, settled in the Transvaal and become a Burgher. He took his captivity in a cheerful spirit. All the prisoners were sent to St. Helena and, I presume, remained there until the war was over. It must have been an extraordinary experience for people who had never even seen the sea (many Boers were in that position) to live for two years on a little island after their unbounded veldt. A Boer farmer was annoyed if he could see the smoke of his neighbour's house in the distance. Strange to think that Cronje followed the great Napoleon to the lonely island.

My duties completed I again left Modder River for Paardeburg, bringing with me gifts of food and other delicacies for G.H.Q. At least I expected a hearty welcome from General Stephenson and Watson Cheyne: was I not carrying ginger nuts for the Consulting Surgeon? My arrival was sufficiently appreciated to produce an invitation to dine with the great ones, but my spirits were a little dashed when I was told I was being posted as Regimental M.O. to a colonial unit called Nesbitt's Horse. At this stage in the war many mounted units had been formed from various sources, mostly from British colonials in South Africa, but also from our overseas possessions. These units were called after some famous General, such as Roberts' Horse and Kitchener's Horse, or named after the man who was instrumental in raising the force. I can recall such names as Loch's Horse, Rimington's Tigers, The Scottish Horse, Imperial Light Horse (trained from Britishers in Johannesburg), Burma Rifles, and there are many more I have forgotten.

I heard an English Tommy Atkins, who was watching a long procession of mounted regiments pass, ask a pal what they belonged to in the Army. His pal was well informed and ruled off a string of this "Horse" and that "Horse." Having listened patiently for some time, T.A. finally lost patience and called out "Anybody here seen Slatterys' Mounted Foot?" A sarcastic reference to a well-known song of the day, descriptive of a humorous body of fantastic Irish patriots. The particular regiment I was to join was called after a Colonel Nesbitt of Grahamstown in the Cape Colony. He was an officer of the redoubtable Cape Mounted Rifles, a semi-military Police Force very much akin to the Canadian N.W. Police, and on retirement had settled at Grahamstown. Consequently the unit was formed mostly of men from that particular district of the Cape Colony. On the very next day I journeyed off and reported myself to the Officer Commanding. A very charming man was Major Currie, said to be a large farmer and popular with everybody. I was warmly received by all the officers and they made me feel quite at home. Of course none of them were Regular soldiers, they had all joined up from their various civilian callings and were good types of the country, representing all walks of life—farmers, barristers, clerks, etc. Their outlook on life and soldiering was

entirely different from professional soldiers, and their ways and methods of carrying on the war were not guided by Field Service Regulations or any written word. The men were much the same type as their officers and cheerfully independent in manners and customs. In fact it seemed to be rather an accident becoming an officer and the use of Christian names between officer and man was quite common, something like this—

Officer: Hey, George, where are my boots?

Batman: What boots, Percy?

Officer: The field boots I told you to clean.

Batman: I haven't had time to clean your b—— boots yet, I will after parade.

Officer: All right, George, but don't forget!

My first insight into the discipline of the Regiment occurred next morning when the O.C. held his Orderly Room at a table outside the Mess Tent. Defaulters were marched up in the approved fashion by the Serjeant-Major, but the subsequent proceedings were not quite so official. I had gathered from conversation at breakfast something quite serious had taken place; one could see the O.C. was silent and serious. He was a man of about 50 years of age, short, powerfully built, blue-eyed, hair just turning grey and he wore a short clipped beard. He looked what he was, a man accustomed to an open-air free life, good shot, good on a horse, a sportsman and a kindly gentleman. His men were to him personal friends, he knew all about them, their homes, their relations, their wives and children. After dealing with a few trivial affairs the case of the day was brought forward. The trooper in question had been detailed to carry out a dangerous duty, to ride alone up to a small kopje when it was extremely likely he would be shot at by concealed Boers; it was necessary to find out if the kopje was occupied and somebody had to take a chance. The trooper objected, not to put too fine a point on it, he said, "I'm d——d if I'm going to get shot for nothing. Send someone else." Naturally he was put under arrest and here he was. Witnesses having given their evidence the accused was asked what he had to say to this grave charge, refusing to obey an order given by his superior officer in the face of the enemy. His explanation was naive in the extreme but intensely human. "Major," he said. "You know me well enough and you know I would not refuse to obey an order that was a just one. I have a wife and three children at home, you know that also, and here I was, told to ride straight up to a Boer position where I was certain to get shot, probably killed. All I said to the officer was, 'Why send me, a married man with a family, when you have plenty of young fellows here who have no ties, take one of them and have some sense!'" Somebody tittered and the Major kept his face with some difficulty. He read the trooper a severe lecture on the enormity of his offence on active service and the penalties he had incurred, but the punishment was not too terrible. There certainly was no court martial; I rather think the man was quietly sent home as not likely to be a very satisfactory

soldier. His punishment would come in explaining to his friends why the Army had no use for his services.

Life was very simple with the colonial troops. At first I found the messing strange after British customs. Cooking was the principal trouble. It was difficult to find a trooper who would so demean himself as to become a "cook," and I fancy changes were frequent and sudden. For some time we had a native boy who could make mealie porridge and coffee of sorts; his efforts were crude in the extreme, and his duties finished suddenly one early morning when the Mess President rose from his seat and gave the black boy a most unmerciful beating. The next candidate was a trooper who claimed to have some experience in culinary matters and condescended to undertake the job. He made it quite clear that it was a condescension on his part and he was standing no "backchat" from any officers. He was quite a character, full of humour and entirely outspoken. At certain times he was inclined to "hit the bottle," but we pretended not to see anything, just waited until he got over his spell. A great thing about him was his capacity to produce some food at any odd hours. We had a horrible custom of marching at dawn and in those cold mornings on the high veldt hot coffee and porridge was good stuff to start the day on. Our trusty cook never let us down. Our other meals were scrappy and casual, but pretty good. We were able to supplement the army rations with various delicacies like venison and chickens, picked up by our scouts on their explorations. We had no use for alcohol; coffee was drunk at all meals and at any odd time of the day or night. If one wanted a drink Cape brandy, known as "Dop," was always available. If a good brand from the Cape it was excellent, had a grape-like flavour, smooth and not a bit fiery. But if picked up at some local store it generally proved to be new raw liquor, powerfully alcoholic and guaranteed to give you a head next morning. All the paraphernalia of the officers' mess were missing. No mess boxes, folding tables and chairs, sparklet syphons, &c., were carried. All the mess trappings went on the floor of a Cape cart driven by our redoubtable cook. (A Cape cart is a double dogcart or trap, has an open hood like a modern touring car and has two horses.) The word sparklet recalls a story. As is still the custom a sparklet syphon was supplied with a box of metal bullets holding the compressed gas. I suppose every officers' mess in British units carried a supply and when used the "Bullets" were thrown away. When the Boers first found these formidable looking weapons they openly accused the English of using large sized explosive bullets!

Luckily for me I had a very good "sick" corporal, a pleasant well educated young man; he knew all the ropes of the unit and put me wise to much. I hereby confess I had no work to do, or very little. The colonial trooper seldom goes sick. He is well accustomed to look after himself in the open; long rides and rough living mean nothing to him; he looks after his horse and takes life as it comes. Take him as a whole he is a natural mounted

soldier and was of the greatest possible use in such a campaign. Boer and colonial grew up to manhood side by side, so it is not to be wondered at that the colonial soldier was very knowledgeable on the subject of Boer methods of fighting. Much of the work done by the regiment was in the nature of scouting. Sending out small bodies of men to ascertain whether certain positions were in Boer possession. I watched some of these expeditions with interest. They would be carried out something like this. Three troopers would move off in a casual way in the direction of the kopje which might, or might not, be held by the Boers. Suddenly one man would pull up short, point with outstretched arm as if he saw the concealed enemy, then all of them would whisk round and gallop off hell-for-leather. This little trick often brought a spatter of rifle fire from the disappointed burghers sitting tight in the hope of bringing off a surprise attack. It was a curious thing that the sound of the Boer mauser rifle being fired in your direction gave a double sound—tick-tock. The Boer was so fond of sniping from long range it was quite common to hear this tick-tock at any odd hour of the day or night from some solitary sniper having a chance shot at us on the move or tucked up for the night. After Paardeburg the army moved on to Bloemfontein, the capital of the Orange Free State, the allies of the Transvaal, who had thrown in their lot with Paul Kruger, the sturdy old President of the Republics. A battle called Dreifontein was fought before the capture of Bloemfontein. Though Nesbitt's horse accompanied the mounted infantry in the fight I have no recollection or record of any exciting moments. After their heavy defeat at Paardeburg the Boers were not in a position to put up much of a defence and Lord Roberts' army entered Bloemfontein on March 13, 1900. According to the gentlemanly methods of conducting war in those days the City was formally surrendered by the City Fathers, the army marched in, or rather camped outside, and most of the inhabitants, and all the shop keepers, hung out Union Jack bunting. There was no shelling or aerial bombing in the year 1900; the civil population were sacrosanct and property inviolable. The army halted to refit. Bloemfontein was crowded with troops. The club was filled with British officers. It was hot and very dusty; flies swarmed over everything.

Modder River again, but on a much larger scale. Typhoid appeared and spread under such conditions. My little Command missed all that trouble as we were moved away miles from the City and went back to our nomadic life. Early in May the Army got on the move again. This time the objective was Pretoria, the capital city of the Transvaal, taking on the way Johannesburg, the City of Gold. The latter was the most important prize and the richest. Some of our men knew Johannesburg very well and were convinced Kruger would blow up every gold mine before he surrended the City. He always hated the place. Had it not produced the Jameson Raid when 600 Britishers rode into the country with the intention of seizing Johannesburg and starting a revolution to

overthrow the President and his Government? To his mind the Golden City was an accursed place to be destroyed root and branch. To the untravelled Colonial this Johannesburg was a wonder city: had it not in a few years with its power of gold built itself great buildings, parks, hotels, theatres. One of the troopers asked me what London was like? I tried to give him some idea of the age, vastness, population and wealth of the City. He listened to me in silence for a time and then said: "London may be a great place, but, man, wait till you see Johannesburg!"

The army advanced rapidly through the Free State but distances were great as the following names of towns to be taken and distances to be covered will show: Brandfort 35 miles, Smaldeel 28 miles, Kroonstad 64 miles, Honing Spruit 26 miles, Rhenoster River 18 miles, and then another 40 odd to "Jo'burg" (we had shortened down the long name). All marching, fighting, and dropping little garrisons to hold our long line of communications. No wonder Kipling wrote of "BOOTS, BOOTS, BOOTS, moving up and down again," and Tommy Atkins spoke of "fifty blinking skylines" day after day. We of Nesbitt's Horse came into little actions fairly frequently; I can recollect sitting on a kopje waiting for the Boers to break cover below us and get away up a long slope over the next rise. Seeing them stream out and gallop off, our men began shooting hard, but doing little damage to the fast moving scattered figures. Mounting and riding forward I found a Boer pony peacefully cropping the grass, the owner sprawled out dead a few yards away. The pony was laden with various impedimenta, including a common or garden umbrella of the gamp variety, strapped to the saddle.

The Boer was fighting continual rearguard actions. We were held up daily as we groped forward to find his strength. Sometimes he got us well exposed and let us have it with "pom-pom" or shrapnel. He got us badly one day as the troopers were dismounted and moving forward on foot. The led horses were being held by the spare men on the reverse side of a rise. The Boer guns opened and sprayed us with shrapnel. One of our men was crouching down holding three horses as a shield round him: I idly noticed that he looked pretty safe when I heard him shout and roll over. A shrapnel bullet had got him through the liver. Approaching Rhenoster River we halted to watch our shell bursting in the trees shading the river. On our left was a small kopje and I could see a group of horses and figures standing looking towards the river through field glasses. I saw a man run down to the horses and come galloping towards us. He reached us and proved to be a young Staff Officer. Smartly saluting, he addressed our O.C. "Lord Roberts' compliments, Sir, and would you please take your regiment down to the river and ascertain if the enemy is holding the bank." He was one of "Bob's" staff and the "great little man" was there himself. The scouts opened out and cantered down towards that peaceful looking strip of green. The Boers were there all right. It was like a Waterloo incident. The C.-in-C., the galloping A.D.C., and the formality

of the polite order. War had some pomp and ceremony in those days. Sad to relate, our popular O.C. became ill. I watched him for some days and decided he had typhoid. Much against his will I sent him to the Field Hospital and we saw him no more. The Adjutant took over command. Appropriately enough, he was the son of the Colonel Nesbitt who raised the Horse. Food was an anxiety. We were often flung away out on a flank and away from dumps and quartermasters.

I distinctly recall an occasion when we killed some goats, extracted the livers and cooked them there and then. We were in too much of a hurry to wait for the rest of the animal. We used to get eggs from Boer farms or Kaffir kraals. From the latter the supply was a gamble; the native likes his egg a bit high. The arrival at a deserted farm was a joyous time should some of the live stock be left behind. Troopers playing pig-sticking with rifle and bayonet was a common sight. Strict orders existed against looting of any sort. When farms were occupied we paid the set prices demanded by the lady owners. One seldom saw a man, except a very old one or a small boy. There is the story of the Irish soldier caught red-handed by the A.P.M. in the very act of bayonetting a sheep. Pretending not to see the frowning officer the soldier, with great presence of mind, withdrew his gory bayonet and plunging it once more into the quivering carcase he cried, "Ah, ha, ye angry baste, I'll tache ye to bite me!"

Our men's equipment got very ragged. Riding breeches gave up the ghost, bare knees and other parts appeared. Boots gave out. I saw a trooper riding with spurs on his naked feet. We must have looked a raggle-taggle crowd. When it rained we got very wet, when the sun of Africa came out we rapidly dried again. Our only protection against the weather was a flea-bag and a greatcoat. No tents, shelters or "bivvies." Should it rain at night it was unpleasant. We were all very fit, but we had to thank the climate of South Africa. I don't think any army could have put up with such continued exposure to the elements for months and years in any other country.

On May 30, we reached Jo'burg. We were sent to seize the waterworks and sit there till the city finally surrendered. We spent a draughty night there and in the morning could look down on the fort still flying the Transvaal colours and keeping up defiance with an occasional crackle of rifle fire. The guns of the Fort were silent. This fort was considered the last thing in a defence work. Built by continental military engineers it looked like the modern stream-lined car. A steel and concrete beetle, said to be bristling with the most modern Krupp guns. Kruger had built it to overawe Jo'burg. It emphasized the power of the Transvaal Republic to those impudent people who came from overseas to dig for gold and demanded votes and rights because they had made the Transvaal a rich country. Suddenly, up went a white flag on the ramparts. Orders came for Nesbitt's Horse to occupy the fort. Proudly we rode down through the streets and

drew up at the low gate forming the entrance to this squat beetle. The gate was thrown open and out marched the Commandant to offer the keys to the victors. He was a stout gentleman wearing a stovepipe tall hat and a black frock-coat. He had a coloured sash draped over his chest and a large sword buckled round his waist. He combined in himself the martial and civic spirit. A curious crowd watched us. One of them pointed at me and said, "That's a 'Verdomdt Rooinek.'" Meaning in Dutch a "damned Red Neck." This was a playful name given to Englishmen who turned red under the South African sun. It was a pretty good shot as I think I was the only man in the unit not a colonial born. We found no guns in the fort. They had been taken away to Pretoria by the retreating Boers. The normal garrison of the fort would have been Staats Artillerie, the regular gunners of the Transvaal forces, but they had gone. There were a few youths in some sort of uniform remaining, somewhat disguised in liquor; I expect they had been drowning their sorrow; quite harmless and pleasant young men in real life. So fell Johannesburg. The retiring Boers did not damage the gold mines.

(*To be continued.*)

Editorial.

REPORT OF THE MEDICAL RESEARCH COUNCIL FOR THE YEAR 1933-34.

In the introductory letter to the Lords of the Committee of the Privy Council for Medical Research, the Medical Research Council report with great regret the resignation of Lord D'Abernon from the office of Chairman, and record their high appreciation of his work for the advancement of scientific research. The exceptional nature of this service has now been recognized by his election as a Fellow of the Royal Society.

In their last Report the Council eulogized the work of their late secretary, Sir Walter Fletcher, and asked for means to commemorate in an enduring way one who gave so richly to the common weal. A memorial fund was opened last June, and the Council report that the response has been so generous that they propose to place a portrait bust in the National Institute for Medical Research at Hampstead, and to use the remainder of the sum collected as the nucleus of a fund for building a Walter Fletcher Laboratory at the farm premises of the National Institute at Mill Hill, to be devoted particularly to those nutritional studies in which he was so keenly interested.

For many years the Council have stressed the importance of improving the facilities available to the study of disease in the human subject, and of increasing the inducements towards clinical research as a career.

The Department of Clinical Research at University College Hospital, London, under the direction of Sir Thomas Lewis, was started many years ago, and its success has been so great that two years ago the Council was able to arrange with the National Hospital for Nervous Diseases, Queen Square, for the establishment there of a Research Department in Neurology under a whole-time director, Dr. E. A. Carmichael.

A new Clinical Research Unit has been formed this year (1934) at Guy's Hospital under the direction of Dr. Ronald T. Grant. A similar unit has also been inaugurated at the Middlesex Hospital by means of a special benefaction by Mr. S. A. Courtauld.

The establishment of whole-time professorships at the new British Post-Graduate Medical School in London will also give excellent opportunities for research work in medicine, surgery and obstetrics.

In consultation with the Board of Control the Council have appointed a new committee to advise on research into mental disorders. An earlier committee was discharged as it had become depleted by death and retirement of its members. An expert committee of this kind is considered to

be a permanent necessity in the organization of the Council. The present need is all the greater as the Board of Control have referred to them an inquiry suggested by the Committee on sterilization: whether vasectomy has any deleterious effect on development if it is performed before the attainment of maturity. This question has been dealt with by experimental methods and the Council have been able to advise that no such effect appears to follow the operation in young animals.

Other subjects for inquiry are the causation of mental disorder, including the part played by hereditary transmission. With regard to the role of inheritance a valuable line of research lies in the examination of the offspring of consanguineous marriages in comparison with other marriages in respect of the incidence among them of mental defect and disorder.

In regard to inheritance and disease in human beings there are the practical difficulties that deliberate matings of individuals showing the characters under study are clearly inapplicable, and observations are handicapped by the small size of human families and the length of the interval between generations. To assist them in the investigation of this subject the Council decided two years ago to appoint a Human Genetics Committee under the chairmanship of Professor J. B. S. Haldane.

Research on influenza, to which reference was made in last year's report, has been continued by Dr. Laidlaw, Dr. Andrewes, and Dr. Wilson Smith. The absence of influenza in epidemic form has limited further experiment on the transmission from the human patient of a virus producing a disease in the ferret. Throat washings from a number of sporadic cases, diagnosed as influenza, have been introduced into ferrets. In only one case was the inoculation successful, the strain from this being apparently identical with that obtained in 1933, and it is significant that the inoculation was made from one of a group of cases occurring in a single household during a localized outbreak. It would appear that the majority of cases diagnosed as influenza have a different cause, or that the virus, if present, has a low infectivity.

The virus previously obtained has been maintained by passage through ferrets and has been compared with the virus obtained by Shope from "swine influenza." The swine virus appears to have a higher invasive power in ferrets than the human strain and sometimes produces pneumonic changes in the lung which have not been seen with the human virus. Attempts at immunization against either virus have not produced a high degree of immunity in the ferret against experimental infection. The serum of a ferret which has recovered from either infection contains antibodies which neutralize the virus when mixed with it *in vitro*, but no degree of humoral immunity yet produced in a ferret, by means other than actual infection, suffices to protect the animal against infection by potent virus applied to the nostrils. It has been found that a similar neutralizing antibody is present in practically all human subjects who have been tested recently. It is proposed to make periodical tests of sera from

sample members of the general population to ascertain whether this general prevalence of antibody undergoes any change in advance of a further epidemic of true influenza.

It was thought that some accessory visible microbe might act with the influenza virus in producing human disease just as the Hæmophilus acts with Shope's swine influenza, but up to the present no hæmolytic streptococcus has been found which with the virus will regularly produce a fatal pneumonia in ferrets.

Just at the end of 1934 it was found that both the human and the swine virus could be transmitted to mice by a simple change in the method of inoculation, and the study of the human virus and of its relation to influenza should now be possible in all laboratories equipped for research.

Dr. Levinthal has continued his investigations on psittacosis and has shown that the infective units when stained by special methods can be seen by ordinary microscopic examination. They have the appearance of a very minute pleomorphic organism measuring between 0·2 to 0·4 micron. Working with Dr. Elford he has obtained independent measurements by selective filtration through graded membranes and the diameter of the infective particle has thus been estimated at from 0·2 to 0·33 micron, a remarkably good agreement with that obtained by direct measurement. Dr. Levinthal has also been able to cultivate the virus in a saline medium containing fragments of chicken embryo, and to carry it without change of virulence through fifteen subcultures. The appearance of the infective agent in these cultures is identical with that seen in preparations made directly from a fresh organ of an infected animal.

The Council state that a most interesting chapter in physiological and medical science is that dealing with the part played by specific chemical agents in the control of the nervous system. Experiments made at the National Institute at Hampstead by Sir Henry Dale and his colleagues make it highly probable that the effectiveness of practically all messages passing from the central nervous system to voluntary muscles and other organs of the body depends upon the liberation—at particular parts of their course—of a very active but unstable substance known as acetyl-choline. Apparently the only exception to this rule is that in the case of messages sent through the sympathetic system, not acetyl-choline but a substance related to adrenaline is the transmitter of activity at the nerve-endings.

In order to describe nerve-fibres in terms of chemical function, not corresponding strictly to anatomical origin, Sir Henry Dale has used the words "cholinergic" for those of which the effects are transmitted by acetyl-choline, and "adrenergic" for those of which the effects are transmitted by a substance similar to adrenalin. According to Sir Henry Dale the preganglionic fibres of the whole autonomic system and the motor

fibres to striated skeletal muscles can now be classed as cholinergic, together with the postganglionic fibres of the parasympathetic division of the autonomic system: thus all the efferent fibres of the peripheral nervous system appear to have a common chemical mechanism for the transmission of their effects, with the exception of the postganglionic fibres of the sympathetic system which are predominantly but not exclusively adrenergic.

These observations are of particular interest in relation to the experiments carried out some years ago by Langley and Anderson on the replacement of the fibres of one nerve by those of another in regeneration. They showed that voluntary motor fibres and preganglionic fibres of any part of the autonomic system could functionally replace one another; and in experiments on the innervation of the pupil Anderson showed that preganglionic or voluntary motor fibres from the third cranial nerve could replace degenerated postganglionic fibres of the parasympathetic system. On the other hand, no functional replacement could be obtained between preganglionic or motor fibres and postganglionic fibres of the sympathetic system. It is now clear that cholinergic fibres are functionally similar to and interchangeable with other cholinergic fibres, and adrenergic with other adrenergic fibres; but fibres employing different methods of chemical transmission cannot replace one another.

The Council state that the specific reaction of nervous tissue to drugs is universally accepted, but the possibility that the activity of the system depends primarily on a series of "drugs" produced in the body itself completely transforms the outlook on the intrinsic mechanism of the nervous system.

Recent nutritional experiments have brought to light other evidence showing the importance of chemical substances in the working of the nervous system.

The work of Professor Peters and his colleagues at Oxford has shown that when vitamin B_1 is deficient in the body, parts of the brain become incapable of oxidizing carbohydrate completely, with the result that lactic acid accumulates and collapse and early death may follow.

Other investigations at Sheffield promise results of significance in this field. It has been shown there that in young animals vitamin A or carotene is essential for the maintenance of the proper structure and function of the nervous system. In its absence widespread degeneration takes place in the nerve-cells and their conducting fibres. While the work of Sir Henry Dale showed the efferent side of the nervous system to be linked with a specific chemical mechanism, the effect of vitamin A is largely on the afferent side; it is the fibres and nerve-cells which conduct impulses into the spinal cord and to the brain, that are specially put out of action by deficiency of this factor.

It is possible that this work will help to elucidate the causation of such diseases as subacute combined degeneration of the cord, pellagra and

lathyrism, where the lesions are almost identical with those produced in young animals by deficiency of vitamin A.

It is also known that xerophthalmia—long known to follow vitamin A deficiency—is due to loss of neurotrophic control of the cornea owing to degenerative changes in the Gasserian ganglion and its fibres in the ophthalmic division of the trigeminal nerve.

The Council consider that in the field of research dealing with the relation of specific chemical agents to the nervous system a scaffolding is being erected which will allow the subsequent building up of a superstructure of knowledge having primary importance both for physiology and medicine.

Through their Industrial Research Board the Council have been promoting investigations into the phenomenon of "accident proneness."

With regard to industrial risks it is well-known that certain persons have a special liability to be the subjects of accidents. It may be found that if a large number of persons are exposed to the same risks 75 per cent of the accidents occurring among them are sustained by a small minority of the group; possibly consisting of as few as 10 per cent. of its number. An entirely different result would be found if the distribution among individuals were due to chance. The phenomenon is independent of any question of responsibility or blameworthiness, the statistical result holds good even although the subject of numerous accidents may appear to have been the victim of fortuitous circumstances or of the actions of others.

The practical consideration is that the number of accidents suffered by any group may be greatly diminished by eliminating the individuals who exhibit special liability.

In factory work it has become a matter of experience that the number of accidents can be materially reduced by removing the accident-prone. The experience extends not only to major accidents involving serious bodily injury but also to those of a minor nature.

An investigation is now in progress dealing with motor accidents. From a statistical examination of the road accident records of four groups of bus and private drivers, totalling 2,604 persons, it has been shown that in each group some persons are more prone to accidents than others. This holds true for all accidents, including those in which the driver was not held to blame. From a careful examination of 179 drivers among the foregoing it appears that those who sustain one kind of road accident, sustain an undue number of other kinds of road accidents; that those who sustain an undue number of accidents in one period do so in another. In fact the preliminary results obtained by the study of motor accidents are similar to those obtained with reference to factory accidents.

The Council state that there are two ways of preventing the accident-prone from engaging in specially dangerous occupations. First, by appro-

priate tests that will detect the accident-prone; secondly, by removing those who in an initial exposure sustain an undue number of accidents. In respect of the first method, psychological tests have not brought this method of dealing with the problem to a stage of practical utility. The second method is more promising and it is thought that the records of insurance companies would contain all the material necessary for preparing tables which would give the average accident-rate of different classes of drivers and would indicate to what extent this must be exceeded by a driver before he can be regarded as specially accident prone. The novelty of this method is that it makes use of information provided by motor accidents and that it is dissociated from any question of blame.

The Council believe that a successful attack upon the problems of road dangers will have to take into account these phenomena of accident-proneness which are being brought to light by scientific investigation.

The Second International Conference on Vitamin Standardization was held in London in June, 1934, and recommended the continued use of the standards already adopted, provisionally, for vitamins B_1 and D. It, however, put forward new standards for vitamins A and C. The new standard for vitamin A is a preparation of pure β-carotene and the unit of measurement is the activity of a certain weight of that material; a sample of cod-liver oil assayed in terms of this standard, and already officially adopted in America, has also been adopted as a subsidiary standard of reference. The standard for vitamin C is now expressed in terms of 1-ascorbic acid.

The Council point out, as an indication of the progress of the chemical study of vitamins, that as regards three of these substances the new standards consist of identified chemical substances. They are confident that animal tests will become of less importance in evaluating the vitamin content of food-stuffs and chemical and physical methods will be more and more applicable. The International Conference has already approved a physical test for the estimation of vitamin A in liver extracts; this involves the determination of the co-efficient of absorption by means of a spectrophotometer and dispenses with the need for a biological test.

We have been able to review only some of the greater activities of the Council; reference to the other sections of the report reveals the numerous investigations relating to health and disease which are being initiated and supported throughout the country. The Council has also the important duty of advising on medical problems arising in the course of the administrative work of various Government Departments. During 1933-34 the applications to the Council for help of this kind have been no fewer than in the past.

Clinical and other Notes.

TWO CASES OF PERINEPHRIC ABSCESS.

By Major N. CANTLIE, M.C.,
Royal Army Medical Corps.

The condition of perinephric abscess is often difficult to diagnose, and the following short account of two such cases may be of interest :—

(1) Private, aged 22. The patient was admitted to another hospital with fever of an irregular type. The usual blood tests were negative. On the fifth day he complained of pain in the left groin, which was generally persistent during the illness. The left hip-joint was held in a position of flexion to ease the pain in the groin. Emaciation was rapid, and by the twenty-second day of illness he had lost fifteen pounds in weight. Total white blood-cells on the fifteenth day was 9,600 per cubic millimetre. He was transferred to my care on twenty-third day with a diagnosis of tuberculosis of the left hip-joint. On admission the most noticeable feature was the deformity of the left thigh, which was flexed almost to a right angle. Extension of the hip-joint caused pain, while the movements of adduction, abduction and rotation were free and painless, which made the diagnosis of tuberculosis unlikely. On standing, there was a marked degree of lumbar scoliosis with concavity to the left. A radiogram of the hip-joints and lumbar vertebræ failed to show any evidence of bone disease.

On the thirty-seventh day tenderness was complained of on deep pressure in the left lumbar region. The total white blood-count was 10,000, with 69 per cent polymorphs. There were no urinary symptoms. I made a note on that day, "The pain over the left lumbar region would indicate a kidney or perinephric affection, but the blood-count does not appear to indicate any severe degree of sepsis." A general anæsthetic was given to investigate the condition of the hip-joint, and the leg was straightened with comparative ease after breaking down a few periarticular adhesions. A Thomas's splint was then applied. The temperature now became markedly remittent, and the pulse-rate averaged 115.

On the fifty-third day of illness there appeared slight œdema on palpation below the twelfth rib on the left side.

Operation was carried out on the next day, a posterior kidney incision being employed, and above the kidney a perinephric abscess having several pockets of thick greyish grumous pus was opened. A culture showed the presence of *B. coli*. Improvement followed for a few days, after which the temperature again became remittent, due evidently to a further hidden source of sepsis. The kidney had appeared normal at operation, and investigation on the occasion showed no extension of suppuration behind

the organ or any track along the ureter. On the seventy-fourth day a fresh radiogram of the hip-joint was taken which showed the presence of an acute arthritis, loss of joint space, destruction of joint surfaces and a commencing ankylosis. The patient's condition was now very poor with emaciation, hectic fever and rapid pulse. A blood-transfusion was accordingly given as a preliminary to operation. At the operation on the following day, the hip-joint was explored by an anterior incision, but on exposure the bones, as far as they could be inspected, were normal, and the joint was free from pus. The wound was accordingly closed without drainage. Following this second operation, the temperature became normal on the seventh day. An autogenous vaccine was prepared and administered. Progress was slowly maintained after this, and the patient was finally invalided with a firm osseous ankylosis of the hip-joint, walking with an elevated sole on the left boot. Scoliosis was still present.

The sequence of events in this case appears to have been: (1) Hæmatogenous infection of the perinephric tissues; (2) irritation of the ilio-psoas muscle causing a flexion deformity of the thigh; (3) postural scoliosis; (4) perinephric abscess; (5) direct extension of infection along the ilio-psoas sheath causing an acute arthritis of the hip-joint. The sheath of the ilio-psoas was not explored at the operation or direct evidence of this might have been found.

The good result following the second operation on the hip-joint is of interest. One cannot imagine that the actual operation proved of benefit as no pus was found and the joint was immediately closed. I believe that recovery was due to the blood-transfusion given the day previous to the operation, the introduction of fresh blood stimulating the resisting powers of the patient sufficiently to combat the infection.

(2) Signaller D., aged 20. This patient was admitted to another hospital in the district with fever, which quickly took on a remittent character. Pain in the lumbar region and a rising leucocytosis were also noted. The usual tests for malaria and enteric group were negative. The urine was normal throughout. The pulse-rate gradually rose and loss of weight was noted. The patient was diagnosed clinically enteric group. On the seventh day of disease the total white blood-count was 18,750, on the twenty-fourth day 24,375, and on the forty-first 31,875.

On admission to my care, on the forty-seventh day, the patient was emaciated and ill. Examination revealed pain and stiffness on movement of the right hip-joint, together with pain in the right loin on palpation and above Poupart's ligament. There was no œdema present in the loin. Radiograms of the hip-joint, pelvis and vertebræ were normal. The total white blood-count two days after admission was 14,400. With the previous case in mind one did not hesitate to diagnose a perinephritis, and an operation revealed a large abscess, which was drained. A culture from the pus showed that *Staphylococcus aureus* was the causative organism. A normal recovery followed the operation, the patient putting on ten

pounds in weight during a period of seven days. He was discharged to duty after an illness lasting sixty-two days.

Choyce's Surgery, referring to the diagnosis of perinephritic abscess, states, "The condition may be mistaken for typhoid fever in the early state, and for hip-joint disease or pyonephrosis at a later period." It is of interest to note that the two cases treated fit this description very well, as tuberculosis of the hip and clinically enteric group were the primary diagnoses in these cases respectively.

Another contrasting feature was the absence of leucocytosis in the first case and the high leucocyte count in the second. Was this perhaps due to the fact that *B. coli* was the causative organism in the former and *Staph. aureus* in the latter?

A CASE OF LOOSE BODY IN THE KNEE-JOINT.

By Major C. B. C. ANDERSON,
Royal Army Medical Corps.

Articular loose bodies are fairly frequently met with in the surgical practice of the Services. The fact that they are usually found in young adults, with a definite history of injury to the joint involved, supports the view that the majority of single loose bodies in these cases can primarily be accounted for by fracture of the articular cartilage and subjacent cancellous bone, rather than to the condition known as osteo-chondritis dissecans.

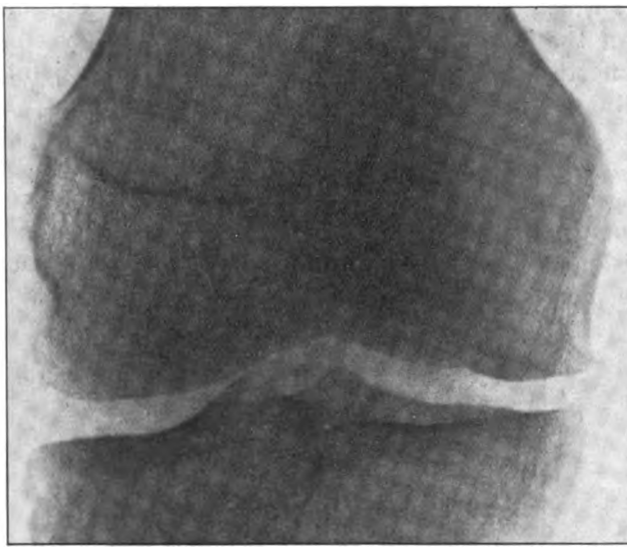
The case described here is remarkable, not for any unusual aspects as regards history, symptoms or treatment, but on account of the dimensions of the actual loose body itself.

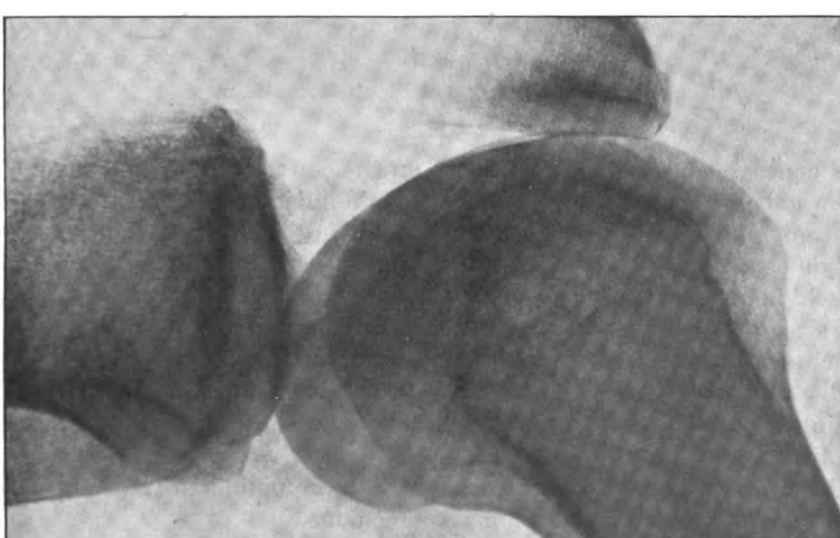
Gunner W., aged 21. Service three years. Reported sick with constant pain and disability in the right knee. The origin of the trouble was put down to a severe "sprain" of the right knee sustained during a game of football. He stated that he had experienced a severe sudden pain on the inner side of the knee which had temporarily disabled him, but that he had managed to finish the game, although with difficulty. His knee thereafter became swollen and painful, but he did not "go sick," and he continued to carry out his duties. The swelling and pain on the inner side of the knee had persisted, and at times he had experienced a "click" in the joint.

About four months after the original injury he was detained in hospital for X-ray investigations, etc., as there was fluid in the joint. Apparently nothing serious was found on this occasion, as he was returned to duty after a course of massage.

The day before he was referred to me for examination he had been playing football, and had "felt something go" on the inner side of the right knee. He was unable to finish the game on account of the acute pain. There was no evidence of "locking" of the joint.

On examination there was well-defined muscular wasting, especially of the vastus internus—no articular effusion could be made out. The range of movement of the joint appeared to be complete, except that some pain





was caused on full flexion and full extension. There was no coarse grating or palpable evidence of a loose body. A tender spot was found over the joint line about ½ inch medial to the ligamentum patellæ.

He was admitted to hospital for further investigation as a possible case of injury to the medial meniscus. The X-ray examination revealed the presence of a radio-opaque area in the centre of the joint in the antero-posterior view, and an irregular line suggesting a fracture running across the articular surface of the femoral condyle. This is well shown in the lateral view of the joint, but it was not possible to say which femoral condyle was affected until an oblique lateral view of the joint was made. This showed that the medial femoral condyle was at fault.

A few days later the patient stated that the pain had shifted to the lateral aspect of the joint, and on examination a definite loose body could be felt moving under the fingers on this side.

In due course the joint was explored under a spinal anæsthetic (percaine) by incision on the outer side, and the large cartilaginous loose body shown in the photograph was removed without difficulty. It had the

usual concavo-convex outline, smooth on the convex aspect and roughened on the concave aspect, and was obviously the major portion of the articular surface of one of the femoral condyles. As no abnormality of the lateral condyle could be defined at operation it must have come from the opposite side which could not, of course, be seen through the limited exposure made. The size of the loose body, measured directly after removal, was 2 by $1\frac{1}{8}$ inches in its greatest diameters and $\frac{1}{2}$ inch in thickness.

The after results of the case have so far been uneventful. He is now walking about without disability, and the immediate prognosis appears to be satisfactory.

From literature available here, I have been unable to trace any report of a loose body of such exceptional dimensions.

I am indebted to Lieutenant-Colonel E. B. Allnutt, M.C., R.A.M.C., Officer Commanding Military Hospital, Gibraltar, for permission to make use of the notes regarding this case.

Echoes of the Past.

THE WAR ON THE CONTINENT, 1793-1795.

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps (R.P.).

While the Seven Years War resulted in a remarkable output of medical literature, including the works of Sir John Pringle, William Brocklesby, Francis Home, and Donald Monro, the contemporary accounts

so far printed of the Duke of York's campaigns in Flanders and Holland at the latter end of the eighteenth century are meagre. The future historian of the Medical Services will possibly find in the War Office

Original Correspondence at the Public Record Office facts of interest necessarily omitted by Sir John Fortescue in his great work on the General History of the Army; meanwhile one or two details from sources more immediately available may be set down.

In January, 1793, England broke off diplomatic relations with revolutionary France, and the French at once declared war on England and Holland. Pitt's government, believing that the quickest way to end the war was to strike at the French colonial trade, made great preparations to send naval and military forces to the West Indies.

But then, as always, the exclusion of any dominant European power from the ports of Belgium and Holland was considered essential for our security; so that, when a French Army under Dumouriez entered the Austrian Netherlands and threatened to overrun Holland, we became involved on the Continent. Large subsidies were voted towards the upkeep of the Austrian and Prussian armies, and everything possible was done to bring the Dutch up to the scratch; but owing to the fact that numbers of Dutchmen had imbibed the tenets of the Revolution, they showed small interest in the defence of their country. In February, the Stadtholder having pressed strongly for a stiffening of British troops, the seven battalions of Guards, the only troops available, were paraded at the Horse Guards, and volunteers called for for active service. The brigade responded to a man, and on the 25th three battalions, forming a force of under 2,000 men, under Colonel Gerald Lake, marched to Greenwich amid scenes of great enthusiasm. Their progress was an example neither of good order nor military discipline, but somewhat typical of the period.

All smoothly went on in the front of our line,
But the rear, O ye Gods, who on earth could define!
Not a single pot-alehouse escaped an assault,
And they drained to the dregs every barrel of malt.
Supported between two battalion men here,
Hissing hot from the bung, reel'd a tall Grenadier.
Two damsels attending his armour to bear,
As drunk as the staggering hero was there.
His arms, belt and pouch the fair Phillida bore,
While his cap Amaryllis triumphantly wore.[1]

The brigade appears to have marched past the King and Royal Family, who had come down to see them off, with the worst cases in carts in the rear, but everyone, including the royalties, was in great good humour. They were rowed to coal barges in the river by some of the Naval Pensioners, about 30 men and two or three women to a boat. Packed like herrings, and by good fortune escaping both shipwreck and suffocation, they were disembarked at Helvoetsluys on March 1.

Meanwhile a weak brigade of infantry of the line was got together under Sir Ralph Abercromby, consisting of the 14th, 37th, and 53rd Foot, which,

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[1] "A Sketch of the Campaign of 1793." By an officer of the [Coldstream] Guards. The cap worn by the men of the Grenadier companies was mitre shaped, the battalion men wore the cocked hat.

with some companies of artillery and a general hospital, joined the Duke of York's command the following month.

The army of this date is described as lax in discipline, entirely without system, and very weak in numbers. Each colonel managed his regiment according to his own notions, or neglected it altogether. There was no uniformity of drill or movement, professional pride was rare, professional knowledge still more so.[1] The worst of the officers were very bad indeed. Fielding and Smollett introduce us to some of an earlier date, but the type was apparently not extinct. Captain Weazle, late valet to Lord Frizzle, encountered by Roderick Random in the road wagon, for whom his lordship, having married him off to a discarded mistress, had purchased a pair of colours in a marching regiment, and the bullying lieutenant in the Bath coach, who put up such a poor performance when the highwayman appeared. On the other hand, there is the worthy lieutenant in "Tom Jones" who was still a subaltern at the age of 50, because his wife would not purchase his preferment at the expense of certain favours which his colonel required of her.

Many new battalions were required, to fill which commissions were freely offered to any individuals who could raise a company. These so-called independent companies, often composed of the worst material, were then drafted with their captain into one or other of the regiments, and with the most deplorable results.

The provision of medical personnel at the commencement of the war rested with the Physician General, Sir Clifton Wintringham, then in his last illness, and Surgeon General John Hunter, the great anatomist, whose assistant was Thomas Keate. A number of officers were recalled from half pay. The physicians appointed by Hunter had all served in inferior grades, and knew the ropes. He himself had a brief experience of active service ten years before.[2] Among the first appointments to the staff of the expeditionary force were Gregory West, M.D.Ab., and Robert Smith, M.D., as Physicians, Thomas Young, Andrew Grieves, and Richard North as Staff Surgeons, John Offrey (29th) and Ralph Rhodes (K.D.G.) as Apothecaries. The Purveyor to the Hospital was Vincent Wood, late Garrison Surgeon at Chatham. On July 17, Hugh Alexander Kennedy, M.D.Ed., L.R.C.P., an Irishman of the staff of the Middlesex Hospital, who had been Inspector during the American War, was appointed Director of Hospitals. The extent of his personal responsibility for the evil reputation his hospitals later acquired, the writer has found no evidence to determine. He retained what must have been a most harassing post throughout the campaign, and died in 1795, still apparently with the army.

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[1] Sir H. Bunbury, "The Great War with France."

[2] At Belleisle, where he described the two heads of the hospital "as unfit for their employment as the Devil was to reign in heaven," and in Portugal, where he also came to loggerheads with his brother officers.

General Hospitals were formed at Chelsea, Deal, Gosport, and Plymouth. Among various appointments gazetted for the staff in Great Britain were those of Donald Monro and John Hunter as Physicians, and William Hunter and Everard Home as Surgeons. The last was the Surgeon General's brother-in-law.

On March 18, the Austrian army under the Duke of Coburg having come up, the French suffered a defeat at Neerwinden, and evacuated Belgium. At the end of May the allies lay along the French frontier, the Duke of York, now reinforced by Abercromby's brigade, two brigades of British cavalry, and a number of Hessian and Hanoverian troops in British pay, holding the part of the line immediately round Tournay with Antwerp as their base and the Scheldt their line of communication. At the same time Ostend was garrisoned and partly used for the landing of troops. On May 24, the British took part in an attack on the entrenched camp at Famars where they gave a good account of themselves. The investment of Valenciennes followed, the place falling on July 28.

During this period, the health of the troops remained good. A general hospital was employed; but the regimental hospitals mainly dealt with their own cases, which was satisfactory to all concerned. Each unit had a pair-horsed spring wagon for ambulance purposes, apart from the four-horse wagons, of which one was issued for general use to each company.

It is probable that a rapid and determined advance on Paris early in August would have ended the war; but, owing to the intense jealousy and suspicion among the allies, effective co-operation was lacking. Each had their own axe to grind. Henry Dundas, the Colonial Secretary, an amateur strategist who was allowed the chief conduct of the war, had set his heart on the acquisition of Dunkirk; and thither the Duke of York's force of some 37,000 men was directed to proceed.

On August 18 occurred the affair of Lincelles, borne on the colours of the three senior regiments of Foot Guards, when the Brigade, led by Lake, charged a body of the enemy five times their number in a fortified position, routed them, and took a colour and twelve guns, having 187 casualties. Advancing through Furnes and Ghyvelde with 22,000 men, including the British infantry, the Duke broke ground on the east side of the town, the remainder, under the Hanoverian Marshal Freytag, forming a covering force. The position was in every way unpleasant. The left rested on a swamp, and, owing to the failure of the war minister to despatch a squadron from England, the right was enfiladed by French gunboats. The water was found to be almost undrinkable, and, apart from battle casualties, which were considerable, there was great wastage from dysentery and fever. Three weeks later Freytag's force was pressed back by overwhelming numbers with the loss of a third of its infantry. The Duke, finding his position untenable, fell back on Furnes with the loss of all his siege train. In the night retreat, one regiment at least, the Inniskillings, lost all their sick, women, and baggage. Dunkirk, from first to last, cost

the allies 10,000 men. The campaign was continued with varying fortunes till the middle of October when the allies went into cantonments for the winter. By this time about 25 per cent of the troops in British pay were in hospital.

The sick wastage among the Austrian troops during the winter was considerable. At the end of February there were 23,400 patients in their hospitals at Brussels, Vilvoorden, Malines, Antwerp, and Louvain. From McGrigor's Reminiscences it is clear that typhus was prevalent on the Continent as well as in Great Britain, and spread extensively in the hospitals. He states that it accounted for thousands in the first year of the war. Among minor affections, ulcers and impetiginous eruptions, due no doubt to pedicular infestation, caused much disability. The accounts of intermittent and continuous fevers in the general literature on the war are too vague to help to estimate the prevalence of any particular one. The year is not recorded as a specially bad influenza one. The British troops suffered from bad feeding and inadequate clothing. The Guards seem to have had great-coats, but, apart from a proportion of "watch-coats" held regimentally, the regiments of the line had no general issue before 1801. To supply their needs, the troops were driven to looting. The officers ordered cardigans for their men at their own expense, and when the need was realized at home, the Lord Mayor of London opened a subscription list to provide coats. Meanwhile the medical authorities at home had been called on to provide for the needs of General Grey's expedition to the West Indies, for Corsica, for Toulon, and for various projected raids on the French coast. Nine regiments under the Earl of Moira were kept hanging about the neighbourhood of Portsmouth and the Isle of Wight during the winter. For the first three months of 1794 they were housed mainly in transports, where typhus took its toll of them. Sir John Fortescue quotes a return made by their Deputy Inspector of Hospitals, Dr. John Macnamara Hayes, showing a constant sick rate in an average strength of 5,000, of about 850 for the period, and 104 deaths.

John Hunter had died in October, when John Gunning of St. George's Hospital succeeded as Surgeon General, and Thomas Keate, an ex-Surgeon of the Guards, as Inspector of Regimental Hospitals. Owing to the poor inducements offered by the Government, the provision of surgeon's mates for the general hospitals was difficult. "Placards were posted on the college gates of Dublin, Edinburgh and Glasgow offering commissions to such as could pass some kind of examination, and were the occasion of many uneducated and unqualified persons being introduced into the service. Not a few apothecaries and even druggists' apprentices found their way in in this manner."[1] A proportion of these turned out a credit to the Army, but others brought grave discredit on the Medical Service.

Hunter's death was followed in January by that of the Physician

[1] McGrigor's Autobiography.

General, and, three months later, Sir Lucas Pepys, who had attended the King during his late attack of insanity, succeeded to the office. At the same time a Medical Board, composed of the Physician-General, Surgeon-General and Inspector of Hospitals, was constituted to manage the medical affairs of the Army. Pepys was a person of great firmness and determination, and seems to have dominated the Board. He was a great stickler for the dignity of the physician as distinguished from the mere surgeon. He had little tact, and was quite ignorant of the ways of the Army. He held the view that no medical degrees or diplomas conferred by any body north of the Tweed were worthy of any consideration, which was awkward considering that the majority of those who entered the Medical Service were Scotsmen.

One of the first actions of the Board was to obtain an order that troops on active service suffering from all but the most trivial ailments were to be treated in General Hospital, which, with the number of new regiments needing medical equipment, sounds a reasonable and almost necessary economy. This was much resented by the regimental surgeons, whose pride and pockets were alike hit by the arrangement, and both the soldiers and their commanding officers had their reasons for disliking it also. At the same time the Board reverted to the pre-Hunterian method of granting physician's commissions to civilians and placing them in medical charge of hospitals.

The campaign reopened in March. The British infantry were as before, but the cavalry were augmented. Some improvement had been made in transport, the soldiers being relieved of their tent poles and camp kettles, which they had formerly carried in addition to their canteens, haversacks, knapsacks and blankets. Much hard fighting ensued, but opportunities were continually missed by the Austrian Higher Command, and no progress was made. Pichegru, a French General of genius, came to the front. The Austrian cavalry were the finest in Europe, and some of the actions in which our own cavalry participated are historic. At Villers-en-Couchies, a battle honour shared between the 15th Hussars and one Austrian Hussar Regiment, the two rode over and dispersed 1,000 French cavalry and 3,000 infantry. At Beaumont (April 26), 12 British and 6 Austrian squadrons scattered 20,000 infantry and took 22 guns. Willens, on May 10, is another honour borne by nine of our surviving cavalry regiments. On May 18, in an engagement round Turcoing, the British were left in isolation by the Austrian General Staff and only extricated themselves with difficulty and considerable loss. The 15th Hussars, who helped to cover the retirement, lost their surgeon, Bradley, and his mate was wounded. The mate of the 3rd Dragoon Guards was reported killed on the 24th of the previous month. Four days later, Fox's brigade, reduced to under 600 men, distinguished itself by the recapture of Pont-à-Chin during the attack on the allied position round Tournai. This honour (Tournay) is borne on the colours of the 14th (West Yorks), 37th (1st Hampshire) and 53rd (1st K.S.L.I.).

At this time the Emperor, who was much more interested in the dismemberment of Poland than the defence of the Netherlands, began to withdraw troops. Hampered by ambiguous orders and lack of support at home, the remainder became demoralized. Ypres fell on June 9. At Fleurus, on June 20, a battle remembered for the employment of an observation balloon by the French, the Duke of Coburg suffered a reverse, and retired on Brussels. Menin, Courtrai, and Charleroi passed into the enemy's hands. The Duke of York's command had sunk to an effective strength of 7,000 when Lord Moira's troops from the Isle of Wight landed at Ostend, raising their number to 25,000. During July he slowly retired through Belgium. On the 14th the last sick convoy was embarked at Antwerp, which was abandoned ten days later. At the end of the month, headquarters were at Rozendahl beyond the Dutch frontier. A correspondent of the *Morning Chronicle* wrote from there on the 31st, "A further retreat is expected. This evening the sick of the army, who are numerous, moved, attended by the whole Hospital staff now in the field, which in case of an affair with the enemy, would prove a serious disaster." The general hospital was re-established at Breda, which in August was the British headquarters. By October, the Austrian army was across the Rhine, the British, Hessians and Hanoverians holding the line of the Waal with Nimeguen on the south bank and the Bommeler Waert, the tongue of land inclosed between the Waal and the Meuse.

The difficulties of the position with the right covered by the Dutch army, most of which was unreliable, are vividly described by Sir John Fortescue. The best of our new army, including the flank companies of some of the battalions sent to Flanders, were in the West Indies. Drafts of recruits arrived to face the approaching winter in slop clothing consisting of a linen jacket and trousers. Demands for fresh clothing were met by the despatch of cloth to be made up regimentally, as in peace time. Many units landed already infected with typhus. The Connaught Rangers, who reached the country in August with James McGrigor as their surgeon, had suffered severely in Jersey, and, on reaching Breda, had 200 cases. The 78th were infected from the lousy blankets issued them on their transports. The country was nearly exhausted of supplies, the commisariat officers appointed by the Treasury were incompetent, and the inhabitants hostile. The new Transport Corps, recruited largely from the hulks, officially the Royal Corps of Waggoners, earned by their behaviour in the field the title of the Newgate Blues.

Almost all the so-called hospital scandals arising on active service can be traced on inquiry to defects of supply and transport. As to the competence of the last, until recent years, the medical men had small if any responsibility. The fact that the adoption of a general hospital system involved the provision of a medical transport service by land or water had been ignored. In a convoy of 120 invalids embarked on one ship, 40 died before arrival at Margate, and others in harbour while awaiting wagons to

transfer them to the military hospital at Deal. On board, food and bedding-straw were alike deficient. While at sea there was always the possibility of adverse winds or inability to make the desired port; there was less excuse for the mismanagement of a convoy of 500 patients transferred from Arnheim to Rhenen 15 miles down the river. On arrival, the hospital was found to be full. The patients were retained in the barges which had been equipped only for a journey of a few hours. Shortly afterwards, 42 dead bodies were thrown out on the canal bank.

The mismanagement in the hospitals themselves reported by the Chief of Staff at this time was due to causes more directly reflecting on the conduct of the Medical Board. Few of the physicians selected by them for responsible positions knew anything of hospital management or the ways of the Army. William Fergusson, then recently transferred from regimental to staff employ, writing several years later, stated that in the general hospitals there was neither system, code nor rule, and as soon as circumstances pressed each became a pest-house. He did his best to teach his C.O. the elements of military hygiene. The shortcomings of the hospital mates have already been mentioned.

By all the rules, the contending armies should have gone into winter quarters in October; but Pichegru, who was now in command of the French, had other ideas.

Bois le Duc was feebly surrendered by the Dutch, and Nimeguen was assailed. At this time reinforcements had brought the strength of the Duke's command up to about 37,000, but what was described as an epidemic fever was raging and there were 7,000 on the sick list.[1] McGrigor, who was acting as surgeon of the 78th as well as of his own regiment, mentions the mortality among the doctors as particularly heavy. He makes the interesting statement that a hospital flag was displayed on the church where the sick lay. It was fired on notwithstanding. The town was evacuated on November 7, and headquarters were established at Arnheim.

On November 27 the Duke of York was recalled. Lieutenant-General Harcourt succeeded to the command of the British troops, and the Hanoverian general, Walmoden, commanded the rest. The cold increased. The Dutch, already in treaty with the French, put every possible obstacle in the way of providing billets for troops or sites for hospitals. Sentries were frozen at their posts and men died from cold in their tents. The ice on the river began to bear, neutralizing its value as a defence, but, in spite of the disaffection of the Dutch, the rest maintained a stout resistance. The sick, as always during the campaign, were, as far as possible, retained near the front. The general hospital of the Brigade of Guards was in the Church of S. Jan at Arnheim; the main hospital was at Rhenen. So long as we held the Bommeler Waert, there was also one at Gorinchem. A

[1] The French seem to have been equally unhealthy. In September their hospitals were packed with cases of "virulent putrid dysentery."

floating hospital at S'Gravendeel, near Dordrecht, is also referred to, where in December the burials were twenty a day and four of the medical staff died. While the rivers remained unfrozen, there was transport by barges from these to Rotterdam or Helvoetsluys. At the last, a hospital for 2,500 was reported in course of preparation in mid-December. Except perhaps for this one, the hospitals were without beds and afforded only such amenities as the billeting area could provide. The newspapers refer sometimes to them as flying hospitals, that is to say they were movable when provided with transport.

There was no unit corresponding to our field ambulance, though it was customary to despatch spring wagons to some selected point prior to an engagement. On the French side, Larrey's *ambulance volante*, providing both sick transport and medical aid, was already on trial at this date.

On January 15 the French attacked all along the line. They were beaten off, but Walmoden, feeling the position to be untenable, decided to retire. The sick at Rhenen were moved to Amerongen ; the hospitals at Gorinchem and S'Gravendeel had arrived at Rotterdam the day before. An officer, writing from there on the 16th, said : " I am here on my way to Germany with sick troops who are dying by scores. We buried twenty-seven this morning who died absolutely of the severity of the weather and the want of proper attention ; outhouses and uncovered barns are the only shelter we can procure for them." The sick at Helvoetsluys, about 700, passed into the enemy's hands, and a certain number of those with the Army, including 300 of the Guard's Brigade, who were considered unfit to move. As to the rest, the *Morning Chronicle* states : " They were taken from their warm beds at midnight and put into carts where they were doomed to continue for many hours without stirring before the cavalcade could proceed ; in this condition several of the unhappy victims were literally frozen to death, others were mad with agony and their cries were beyond description. In this state they were to be dragged near 100 miles without succour."

The retreat which followed was one of the most disastrous in our military history. It lay across a desolate tract over which the piercing wind drifted the snow in ridges barely passable by wheeled transport. The scattered villages afforded few billets, and the inhabitants barred their doors against the troops. Leadership among the company officers was conspicuous by its absence; except in a few notable instances discipline was lost, and the units fought each other for the scanty comforts obtainable. The road was strewn with dead horses and abandoned baggage; men, women and children lay huddled up together and frozen in the snow. Three hundred soldiers died from exposure, apart from the deaths among camp followers. Deventer, on the bank of the Yser, was reached on the 19th, and in the next few days several stragglers were brought in. After a week's halt, lack of supplies and the hostility of the inhabitants compelled the Army to resume its march. Here 600 sick, with three regimental officers and medical attendants were left.

After the Duke of York's departure, the confusion in the hospital arrangements seems to have increased. In an account written apparently by a corporal of the Coldstream on January 21, it is stated that, "Our hospitals, which were so lately crowded, are for the present considerably thinned. Removing the sick in wagons without clothing sufficient to keep them warm has sent some hundreds to their eternal home, and the shameful neglect through all that department makes our hospitals mere slaughter-houses. Without covering, without attendance, and even without clean straw and sufficient shelter from the weather, they are thrown together in heaps, unpitied and unprotected, to perish by contagion, while legions of vultures down to the stewards, nurses, and their numberless dependents, pamper their bodies and fill their coffers with the nation's treasure, and like beasts of prey fatten on the blood and carcases of their unhappy fellow creatures, of whom not one in a hundred survives, but perishes under the infernal claws of these harpies, still thirsting for more blood and rioting in the jaws of death."[1]

On March 3 the remnants of the Expeditionary Force lay along the east bank of the Ems, with headquarters at Osnabrouk. When all the stragglers were in, the loss of the British regiments since leaving the Leck was found to amount to about 6,000, of which less than 10 per cent were battle casualties. Meanwhile Pichegru had overrun Holland. The Dutch fleet, frozen in at the Texel, was captured by the French cavalry. A few of our transports managed to get to sea, others were scuttled in harbour. Numbers of our men were prisoners of war.

Various recorded incidents in this campaign have an interesting bearing on the provisions of the Geneva Convention of after years. The question of the abandonment of the hospitals to the enemy at the commencement of the retreat was naturally raised. But, apart from the bad moral effect on the troops and the fear of what might be said at home, the behaviour of the Parisian mob and their leaders during the Terror had caused a popular belief, encouraged possibly by those in London responsible for war propaganda, that all Frenchmen were tarred with the same brush, and were in fact inhuman monsters. The war proved, however, that, deplorable as their political views may have been, the French soldiers and their general fought like gentlemen. On December 11 a party of soldiers' wives who turned up at Bergen-op-Zoom spoke most warmly of their treatment while in the enemy's hands. Major McMurdo and the officers left behind with the sick at Deventer were returned. On February 15 a British officer was sent from England with surgeons and medical stores to Helvoetsluys. By this time many of the sick had been sent up country to convalesce, the remainder, including the medical staff, were unanimous in testifying to the humanity of their captors, who had supplied all medical comforts needed. Orders had been given for the repatriation not only of the surgeons, but of

[1] Annual Register, 1795.

the sick attendants, who were of course combatants, so soon as they could be spared, and of the equipment of the hospital. On April 5 a shipload of sick, women, and children, escorted by French soldiers under an officer, put into Margate. The same good feeling was manifested on both sides in the Peninsular War, but, though some mutual agreement regarding the status of the hospitals and their attendants was tentatively suggested, no compact was ever made.

In April Prussian troops relieved the British infantry. On the 2nd fourteen transports with sick came into Yarmouth, the patients being distributed in the new barracks at Colchester and Chelmsford. The cavalry remained to the end of the year, the infantry to the number of 15,000 with some of the artillery were embarked at Emden a fortnight later. Among the medical staff left behind was Robert Jackson, surgeon of the Buffs, whom the Duke of York in defiance of the Medical Board had promoted to be Physician and Inspector of Hospitals for the Cavalry. How the sick prospered under his care we do not know, but we can be confident that, if they died, it was not from want of energetic treatment. A painful proof that apparently the Physician General put his own dignity before the welfare of the troops is the fact that he refused to answer Jackson's official letters.

"Dundas' idea of putting an army in the field was to land raw men on a foreign shore and expect discipline, arms, ammunition, clothing, victuals, medical stores and medical treatment to descend on them from Heaven" [Fortescue]. The co-ordination of the various departments involved in dealing with the sick and wounded of a force which in the summer of 1794 amounted to something like 40,000, proved beyond the powers of Craig, the Chief of Staff, who wrote of the Medical Service in August that "every branch and every fibre of every branch draws a contrary way." The Director of Hospitals, whose official status in those days approximated to that of a camp follower, could hardly assist him much in the matter. The Duke of York's interest in the welfare of his men is a matter of history, and while he remained with the army he endeavoured to ensure the comfort of the patients in general hospitals by ordering the Field Officer of the day to make frequent inspections at uncertain intervals. The worst disorders seem to have occurred after his departure. At this time the hospitals, occupying the same relative position in the line as our own divisional medical units, began to suffer from the poverty of supplies, absence of billets, and the hostility of the Dutch, which affected the whole army, and few amenities were available. Every available man was needed to hold the extended front, and good soldiers could not be spared as sick attendants.

Regarding the allegations of callousness and neglect on the part of the hospital staff, it is only fair to say that, traced to their source, they originated mainly in the literary activities of two Coldstreamers, an officer and a corporal. Similar general accusations, based on a single visit to a newly-formed hospital during an abnormal influx of casualties, were made

in the early days of the Crimean War. It is not unlikely that the experience of both these witnesses were confined to their immediate surroundings. On the other hand, we have reliable medical evidence of the muddle, indiscipline, and overcrowding which prevailed owing to the inexperience of the Medical Board's nominees. The death-rate was increased by this factor, and the Board cannot be acquitted of responsibility. The moral is to be found in Napier's statement. "Professional skill is of little value in comparison of experience in military arrangement. Where one soldier dies from want of a delicate operation, hundreds perish from the absence of military arrangement."

George Guthrie has stated in his *Surgical Commentaries* that the campaign did nothing for the advancement of British Surgery. At that date such principles as there were were based on the teaching of John Hunter, whose experience of active service was limited, and of J. Bell, who had none. Guthrie disagreed with Hunter's view that a necessary amputation should be deferred for some weeks "till the patient's constitution should have become accustomed to the injury." He stated also that ligature of the femoral artery high up in the thigh, an operation designed for the cure of aneurysm, was then being applied generally to wounds of all its branches, even in the leg, and with disastrous results. Bell taught that, owing to the impossibility of adequately compressing the main arteries, a shoulder joint amputation was very rarely justified, and that one at the hip-joint was murder.

By a comparison of the gazettes with Colonel Johnston's Roll, the names of most of the medical staff officers engaged in this campaign can be recovered. The names of the regimental surgeons who actually served with their corps during the war are not easy to determine. Numbers were moved to the staff and their duties performed by regimental mates, who, being warrant officers, are not found in the Army Lists.

Physicians.

Director of Hospitals: Hugh Alexander Kennedy, M.D.Ed., L.R.C.P. *Deputy Inspector, Lord Moira's Force*: Sir John Macnamara Hayes. Gregory West, M.D.Ab., Robert Smith, William Moore, F.R.C.P., Charles C. McClurin, Thomas Sutton, M.D.Leyden, L.R.C.P., Edward G. Clarke, M.D.Ab., John Rogerson, Robert Jackson, M.D.Leyden (from the Buffs, 1795). *Moira's Force*: George Morris, M.D., Paggen Mayo, M.D., William H. Matthew, M.B.Camb.

Surgeons to the Forces.

Thomas Young (Senior Surgeon), Andrew Grieves (53rd), Richard North, John Mallet (11th D.), William Tudor (2nd D.G.), J. Goodsman (37th), Peter Oliver (K.D.G.), John Joberns, Francis McDonnell, George Hollings, Charles Griffith, Joseph Kearsley (O.M.Dept.). *Moira's Force*: Thomas Howden, John Gunning, Henry B. Worth.

Surgeon, Guards Brigade.

Archibald Mearns.

APOTHECARIES.

John Offrey, Ralph Rhodes, John Ramsay (14th), Thomas Foster (1st D.), St. Leger Hinchley (8th D.), John Bolton (6th D.), John Hannay, William R. Shapter (2nd D.). *Moira's Force*: Archibald Douglas (44th). William Stafford (27th), Adam Turnbull (57th), Robert Wightman.

PURVEYORS.

Purveyor: Vincent Wood. *Deputy Purveyors*: Charles Morris, Thomas Wilson, Hugh Brown (53rd), T. B. Hugo (Mate, Coldstream Gds.).

REGIMENTAL SURGEONS.

Some of those promoted are mentioned above. James McGrigor (88th) arrived late in '94. His mate was Mr. Nicol. George John was surgeon, Royal Wagon Train. Bradley (15th D), killed at Turcoing, was perhaps recently promoted in the field.

MATES.

Among the regimental and hospital mates who were afterwards distinguished were Dr. Wm. Fergusson, Sir James R. Grant, James Borland, Sir John Webb, Sir James Fellowes.

Current Literature.

ORPWOOD, R. M. **A Rare Sequel to the Schick Test.** *Brit. Med. Journ.*, February 16, 1935, Correspondence, p. 331.

This letter reports a case of an adult, aged 27, on whom the Schick test was performed in the usual manner. A typical positive reaction of moderate intensity developed between forty-eight and seventy-two hours later and faded five weeks from the date of the injection.

Four weeks after the reaction disappeared numbness developed on the arm at the site of the injection, the area affected gradually increasing until at the end of two weeks it measured 6½ inches long and 2 inches wide. There was complete loss of sensation to touch and pain and partial loss to heat and cold.

Six weeks later normal sensation was restored.

It is suggested that the condition was due to a specific localized toxic effect of the reagent employed.

SEYMOUR, F. R., M.A., M.D. **Men and Masses.** Chadwick Lecture. *The Medical Officer*, January 26, February 2 and 9, 1935.

This interesting paper is described as an attempt to evaluate the relative merits of the preventive medicine of the nineteenth century with its attention to environmental conditions and of the methods of personal preventive medicine practised in the present century.

The subject is considered in three phases. The first of these—*the curative phase*—deals with a period in which disease, especially in its

epidemic form, was considered to be a punishment for disobedience to Divine law and in which prevention as we understand it did not exist.

About the middle of the eighteenth century, however, both Pringle and Lind in their works dealing with "The Diseases of the Army" and "The Means of Preserving the Health of Seamen" respectively began to crystallize ideas of mass prophylaxis although their efforts were directed towards the welfare of limited classes.

The second, or *environmental phase* developed from the realization that epidemics were the culmination of a process of cause and effect and protection of the masses from the spread of disease on wide general lines was an obvious corollary. To reach this point the conception of a causative agent of infectious disease had to be developed, mainly on circumstantial evidence, but with the rise of bacteriology it became possible to define a causal relationship between living organisms and certain infectious diseases while in other cases sufficient knowledge was available to permit of such a relationship being assumed.

The Fathers of Bacteriology, however, warned us not to seek the elucidation of the mysteries of epidemics in the laboratory but to link up the knowledge there acquired with that of the clinician and epidemiologist. Germs may be potent causes of mischief but the effects produced by their entrance into the human body depend on many variable factors.

Among epidemic diseases the beneficial effects of environmental hygiene are most marked in infections of the alimentary tract and in certain respiratory infections, e.g. tuberculosis and diphtheria, the causal agents of which are capable of surviving for some time, or even multiplying, outside the host's body. The reverse is the case in influenza, measles and whooping-cough, but it would be unwise to consider these diseases less amenable to environment because anything that lessens the opportunities for transference of infection will tend to reduce their incidence.

In the environmental phase the aim was to prevent the spread of infectious disease and to protect man in the mass by indirect means.

Early in the present century it was realized that some new line of attack was necessary if the infectious diseases less capable of being affected by environmental hygiene were to be tackled successfully. It also became manifest that diseases other than those due to infection might be preventable and preventive medicine entered on *the third phase*. The aim of this phase is defined as prevention in the mass by attention to the units of which the mass is composed and its main lines of action are typified by the work of the School Medical Service, the Venereal Diseases Scheme and agencies of a similar nature.

Meanwhile our knowledge of infectious disease had extended and among other things it had become apparent that the protection of individuals from definitely recognizable illness is not the same thing as efficient protection of the mass. The reaction of the mass, as a whole, to an infectious disease is not equal to the sum of the reactions of individuals of

which the mass is composed, and the hope of the general protection of the mass is based on two fallacies: first, complete protection is not generally possible, and second, failure of protection with consequent invasion by a pathogenic organism is not always followed by clinical manifestations.

To these infected non-sick the name of carriers is applied and such individuals form a reservoir of infection and may maintain such infection in the community so long as a supply of susceptible new material is available. Any marked rise in the carrier rate may be followed by the occurrence of clinical cases.

Inoculation, or pre-immunization, has been practised against a variety of diseases and may be effective in protecting an individual but what are the effects on mass immunity if only a proportion of the units composing it are protected? Greenwood, quoted in reply, states that animals exposed to special risks of infection for a limited period derive great advantages from pre-immunization but, in a continued unfavourable environment, this method will fail to control the disease. In other words the inexpensive pre-immunization method is not a substitute for the expensive method of improving environment and although it may be necessary to adopt it under special conditions there is no reason why the advantages that may slowly but surely follow improved environment should be neglected.

SCHULEMANN. **The New Synthetic Drugs.** *The Indian Medical Gazette*, 1935, v. 70, No. 2, 83-88.

This paper was originally read at the Instituto di Malariologia, Rome, in August, 1934.

The author points out that a decade has passed since the discovery of plasmochin and briefly discusses the elaboration of this compound and the complementary drug atebrin, together with the laboratory trials of these on bird malaria and later on cases of therapeutic infections with malaria parasites. Dr. Schulemann, however, very definitely agrees with the Malaria Commission of the League of Nations that even the results of tests on general paralytics infected with malaria do not permit of final conclusions being drawn. As regards the value of plasmochin he prefers to base his opinion on the history of the Malaria Convalescent Depôt at Kasauli which closed down for lack of material following the routine treatment of cases by a combination of plasmochin and quinine and cites Sinton's figure of 8·5 per cent relapses under this treatment as compared with 70 per cent when quinine alone was given.

Plasmochin has a definite action on the gametocytes of *Plasmodium falciparum* and a slight action on the asexual development of this parasite but acts less definitely against both the sexual and asexual forms of *P. vivax* and *P. malariæ*.

The knowledge that plasmochin acted more strongly against the gametocytes induced Muhlens to combine it with quinine, and practical experience

has shown the optimum proportions of the two drugs to be 30 : 1 as present in quino-plasmoquin.

Practical experience has also shown that in the smallest daily doses plasmochin is capable of rendering the gametocytes of *P. falciparum* non-infective to mosquitoes, the minimum dosage required to attain this result being 0·02 gramme (⅓ grain) twice weekly.

Following on the experience gained when dealing with plasmochin it was easier to arrive at conclusions as to the value of atebrin which has been found to act on the schizonts but not on the gametocytes and its results correspond with those of quinine.

Plasmochin may give rise to abdominal pains, but so far no explanation of this has been found, the drug apparently having no action on the mucous membrane or musculature of the intestinal tract.

It may also, especially when given in relatively large doses, cause cyanosis depending on a reversible action which results in the formation of methæmoglobin. Mild cyanosis may appear in a small percentage of cases when doses of 0·03 gramme are given, but disappears rapidly when the drug is discontinued.

These toxic symptoms show enormous individual variations and may be affected by race, diet and the existence of other diseases.

Out of the millions treated with plasmochin some twenty fatal cases have been reported. In these cases an acute hæmolysis has occurred even with small doses of plasmochin similar to, but not identical with, that which occurs in blackwater fever following quinine. No clue has been found as to the cause and Amy is quoted as having produced evidence that it is not due to fluctuations in the toxicity of the drug.

The simultaneous administration of quinine and plasmochin improves the tolerance of the latter.

Atebrin also sometimes causes abdominal pains but these are neither frequent nor severe. In addition it gives rise to yellow discoloration of the skin due to the formation of an acridin pigment; it does not affect the liver and never gives rise to jaundice.

The simultaneous administration of plasmochin and atebrin gives rise to abdominal pain in a high percentage of cases and experiments are in progress to discover some method of overcoming this objection to the use of these drugs together.

A very complete bibliography follows the article.

U.S. Public Health Services: A New Concept of Biological Methods of Sewage Treatment. *Public Health Reports*, February 1, 1935. v. 50, No. 5.

Under this heading is published a preliminary note indicating the results of recent investigations into the action of activated sludge in the purification of sewage.

The main feature of these results is the identification of the adsorbent

principle in activated sludges as a base exchanging substance similar to the zeolites used in various water-softening apparatus. This adsorbent principle is found in the gelatinous matrix of the sludge, and can be regenerated by sodium chloride in exactly the same manner as the commercial zeolites, although under natural conditions this reactivation is carried out by the bacteria normally present.

The publication of a series of papers describing the various steps leading to these most important results has been promised, and their appearance will be eagerly awaited by all students of this hitherto difficult problem.

CHORINE V. **Mechanism and Application of Henry's Reaction.** *Rivista di Malariologica*, 1934, v. 13, Fasc. 6, 808-822.

In this article, which is written in French, the author continues his studies of the melano-flocculation reaction in malaria, and shows that the results are not due, as Henry believed, to the presence of specific antibodies in the sera of malaria cases. He considers that the flocculation of melanin in such cases is mainly due to the increase of euglobulin in the blood, and that the negative results obtained during febrile periods are due to suspension of the action of euglobulin by the increased saline constituents present in the blood at such times.

It is also shown that flocculation of serum in distilled water is of the same nature as melano-flocculation, and that results obtained by this method vary in exactly the same way as do those obtained by melano-flocculation.

For the distilled water-flocculation test blood should be taken during an afebrile period and kept for not more than twenty-four hours in the ice-box. Only perfectly clear serum should be used and the glassware employed should be scrupulously clean. Two tubes are used for each test. Into one of these is placed 1·8 cubic centimetres of distilled water and 0·2 cubic centimetre of the serum under test; the contents are mixed thoroughly and transferred to the container of a photometer where a first reading is made. The second tube is dealt with in exactly the same way, the photometer readings in each case being made as rapidly as possible. The tubes are then placed in an incubator at 37° C. for three hours, withdrawn and kept at the laboratory temperature for twenty minutes, when second readings are made in the photometer.

The final result is obtained by subtracting the figure for the first reading from that for the second and should not vary, in careful hands, for the two tubes containing the same serum by more than 2 or 3.

Final figures below 10 are obtained from non-malarial sera; from 10 to 20 the serum may be suspect, but in this zone of flocculation the result may also be due to syphilis or tubercle. Figures from 20 to 90 indicate a malarial serum, and where the difference between the first and second

readings is 100 or more there is presumptive evidence of the existence of visceral kala-azar.

The value of the Henry reaction lies in the fact that a negative reaction is evidence of the absence of malaria, while a positive reaction is only a presumptive sign of the presence of the disease.

A very complete bibliography accompanies the article.

Reviews.

ANNUAL REPORT OF THE SURGEON-GENERAL, UNITED STATES ARMY, 1934. Washington: United States Government Printing Office. Pp. 197. Price 15 cents.

This annual report deals with the vital statistics for the calendar year 1933 and with general matters pertaining to the medical services for the fiscal year ending June 30, 1934.

The mean actual strength of the Army in 1933 was 136,491, an increase of 4,566 over the previous year. Of the total, 14,241 were officers, 111,664 enlisted white men, 3,252 enlisted coloured men, the remainder being Filipinos and Puerto Ricans.

Of the enlisted white men, 73·8 per cent were stationed in the United States, 12·7 per cent in Hawaii, 8·4 per cent in Panama, and 3·8 per cent in the Philippines.

Health was very satisfactory during the year, the total admission rate being 579 per 1,000, as compared with 651 per 1,000 in 1932. The admission rates for whites both in the United States and Hawaii were lower than in 1932, but in other stations were higher, the rate for Panama, which has shown a progressive increase for the past five years, being 1,152 per 1,000 of strength.

The main causes of admission were athletic exercises (3,876), bronchitis (3,532), influenza (3,507), gonorrhœa (2,863), acute tonsillitis (2,487), chronic tonsillitis (2,464). This is the first time that injuries from athletic exercises have headed the list, while the admissions for venereal disease have shown a new low record of 34·4 per 1,000, compared with 42 per 1,000 in 1932. In China, where the rate in 1932 was 102 per 1,000, in 1933 it fell to 55.

Experiments with hexylresorcinol in the prophylaxis of gonorrhœa have been continued, and the results have been so satisfactory that a further trial on an increased scale is now being carried out.

The malaria admission-rate increased from 4·7 per 1,000 in 1932 to 6·7 in 1933, the main increase occurring in Panama where the rate rose from 31·9 in 1932 to 65·9 in 1933.

In accounting for the higher incidence in Panama, it is pointed out that

the water level in the Gatun Lake in 1933 was the lowest for several years and that profuse algal growths, which have formed in the lake during the past ten years and are usually submerged, come to the surface in dry seasons and act as a huge breeding area for *Anopheles albimanus*, the dangerous mosquito of the Canal Zone.

The Supply sub-division of the Surgeon-General's Office reports that the supply of the most modern types of equipment has been continued throughout the year to the extent of available funds, among the items noted being such articles as electric refrigerators and stainless steel kitchen and dining hall equipment.

The Cost Accounting sub-division reports the results of an investigation of the cost per patient day, which, based on data obtained from five general and one stationary hospital, amounted to $4.6013.

During the fiscal year 1934, 33 lieutenants from the Medical Corps Reserve were posted to the Regular Army, having qualified for appointment in 1933 as a result of having held interneships in Army hospitals, having passed an examination, and having been found suitable on other grounds. Owing to the reduced income from the care of Veterans Administration beneficiaries, it has been found necessary to suspend the appointment of internes, and 46 candidates who qualified in March, 1934, for commissions in the Regular Service through examination will be appointed in 1935 without holding these hospital appointments.

The full strength of officers in the Medical Corps on June 30, 1934, was 941, the numbers in the various ranks being : major-general, 1 ; brigadier-generals, 2; colonels, 65 ; lieutenant-colonels, 109; majors, 484 ; captains, 236 ; lieutenants, 44.

The strength of commissioned officers of the Medical Department Reserve Corps was 12,052, compared with 11,936 in the previous year. It is stated that a survey of the reserves reveals that the strength is approximately 57 per cent short of the objective, " A far from satisfactory condition which has been brought about by the failure of the Corps areas to reappoint medical reserve officers whose activities in civil life fit them for assignment to technical or professional duties."

The strength of enlisted men in the Regular Corps was 6,505, and of these 571 belonged to the veterinary service.

One of the most interesting parts of this Report is that dealing with the Army Medical Library which, beginning in 1818, has become not only an American national institution, but has become known as the greatest collection of medical literature in the world. It is considered a matter for great regret that financial stringency has during the year under review limited the purchase of books and periodicals. In addition, for the first time since 1880, no volume of the Index Catalogue of the Army Medical Library has been issued or prepared, and no funds are available for the continuation of this publication. The resulting loss to the medical profession of the world cannot be over-estimated.

EXPERIMENTAL BACTERIOLOGY AND ITS APPLICATION TO THE DIAGNOSIS, EPIDEMIOLOGY AND IMMUNOLOGY OF INFECTIOUS DISEASES. Vol. II. By Dr. W. Kolle and Dr. H. Hetsch. English version incorporating further revision. Edited by Professor John Eyre. London: George Allen and Unwin, Ltd. 1934. Pp. 613. 118 plates and 200 test figures. Price 30s. net.

The first volume of this textbook was briefly reviewed in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS of January, 1934. The volume under review has maintained the high standard of translation and reproduction exhibited by its predecessor.

In this volume the consideration of specific infections is continued. The opening chapters deal with tuberculosis, leprosy, relapsing fever, Weil's disease, syphilis and yaws. Then follows a useful chapter on chemotherapeutical problems.

The morphological and biological features of the protozoa are briefly considered, and amœbic dysentery, trypanosomiasis in man and animals, malaria, piroplasmosis, and coccidiosis are fully reviewed.

The concluding section of the volume is concerned with the filtrable viruses, the principal infections falling into this category being fully described. It is in this section that difficulty is naturally experienced in including an up-to-date account of subjects which have within the last few years provided such a prolific field for research. The delay necessarily attendant on the production of a translation obviously accentuates this difficulty. As an example it may be mentioned that no indication of the possibility of active immunization is given in the chapter dealing with yellow fever.

The volume concludes with some useful information concerning infectious diseases of obscure ætiology, and a chapter on infections caused by fungi and yeasts.

H. M. P.

CLINICAL SCIENCE. By Sir Thomas Lewis, C.B.E., F.R.S., M.D., D.Sc., LL.D., F.R.C.P. London: Shaw and Sons, Ltd. 1934. Pp. viii + 189. Price 12s.

In a volume of collected papers Sir Thomas Lewis gives us the results of some of his most fruitful and interesting researches. The author's object is to stimulate inquiry and observation among students and practitioners along clinical lines, and his main contention is that useful research can be done by the average man who is unprovided with elaborate apparatus if he will but use the faculties of observation and deduction given to him by Nature.

In the course of this stimulating and highly interesting volume Sir Thomas treats of many different subjects—all in that masterly manner which stamps his work as that of the true scientific research scholar.

It is a book full of important information on many subjects; information that will not readily be found elsewhere.

AMŒBIASIS AND AMŒBIC DYSENTERY. By Charles F. Craig, M.D., M.A. (Hon. Yale), F.A.C.P., F.A.C.S., Colonel, United States Army, Retired, D.S.M. London: Baillière, Tindall and Cox. 1934. Pp. viii + 315. Figs. 54. Size 10½ + 6½. Price 22s. 6d.

This book, which deals entirely with amœbiasis, is the first of its kind to appear for several years, and embraces all the important advances in our knowledge of the ætiology, epidemiology, prophylaxis and treatment of the infection. Much of the literature written on this subject has been published in research or medical journals, and many of the textbooks do not give sufficient detail, consequently a book such as this is welcome.

The chapters on diagnosis are worthy of special mention, and bear evidence of the author's wide knowledge and experience of the disease. The chapter on the complement-fixation test deals exhaustively with the technique, the specificity, and the value of the test in diagnosis and control of the disease.

The book is most comprehensive, easy to read, and extremely well-illustrated with photomicrographs. It can be strongly recommended as a textbook which deals with a disease of great importance in the Army.

"VIA YPRES." By Allan Jobson (72109, Private, R.A.M.C.). The Westminster Publishing Co., 1934. Price 8s. 6d.

This is something new in War books. It is the story of the field ambulances of the 39th Division from an unusual point of view; being told by a Private of one of them.

The Division landed in France in March, 1916, and remained there until, having suffered heavily during the German offensive of March, 1918, it was disbanded, the field ambulances being subsequently attached to an American Corps.

The story is well told and well written, the work of the bearers being graphically described and vivid pictures given of the hardships with which they so successfully competed.

One chapter is devoted to the A.D.M.S., a well-known officer of the Corps who had retired shortly before the War. His enthusiasm, energy and popularity are well brought out.

General Sir Hubert Gough, G.C.M.G., K.C.B., etc., has written a most appreciative Foreword.

The book is well got up and has interesting photographs of various medical posts. Though it inevitably contains the record of the numerous moves of the unit concerned it is full of interesting matter and well worth reading. C. R. M.

EDITORIAL NOTICES.

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Journal of the Royal Army Medical Corps.

Original Communications.

FIELD AMBULANCE WORK IN MOUNTAIN WARFARE.

BY MAJOR T. O. THOMPSON,
Royal Army Medical Corps.

THE following notes on the work of a field ambulance in mountain warfare should be regarded only as notes, and in no way as an authoritative dissertation on this type of field ambulance activity.

The notes are based on experience and recollections of two very pleasant years enjoyed with a field ambulance, employed continuously at one of the big frontier garrisons on the North West Frontier of India.

It should be emphasized that no attempt is made to criticize authorized establishments, equipment or other details. If it appears that criticism of these is being made, apology is offered as these notes merely represent personal experiences and opinions based on these subjects.

The field ambulance, in which this experience was gained, had been a formed unit for quite a number of years, and therefore was an established and going concern. In addition, we were fortunate in finding that a fair percentage of the senior other ranks had frontier experience varying from five to ten years of continuous service. These experienced hands were an enormous asset in the training of the unit, and taught us all many useful details of this type of work; with the result that, when we came to the crucial test of actual action, everything went like clockwork, and the unit received a good share of the verbal bouquets which were flowering at the time.

It is with the hope that these notes may be of use to others, who find themselves cast into this area of service, that we venture to bring them

together, and offer them for publication in the JOURNAL. It is hoped that, random and disconnected as they probably appear, they may add something to the rather scanty literature of the subject and be of value to others in the future.

The field ambulance was, at the time, formed on the old type of establishment, namely a unit composed of four sections; one equipped for dealing with British troops, and three for Indian troops. Each section was, for all practical purposes, self-contained, and could be split off as a minor separate unit. In fact, in many cases, such a sub-unit used to form the entire medical establishment for a small detached force.

The main advantages of this establishment were: firstly, the ease with which these sub-units could be released at short notice for a small detached force; and secondly, that, in an advance or retirement of a long column, the sections could be very easily "leapfrogged" past one another for the formation of an A.D.S. or M.D.S.

It may be worth while noting that the practice of using *small* detached forces is no longer popular with senior commanders experienced in frontier warfare. The modern tendency is to use large and well-equipped forces of a brigade strength as a striking column.

The modern establishment has been made to conform to that employed at home, and has a headquarters and two companies. This now forms the normal establishment for all field ambulances except a very few permanent units in specialized areas. The tactics and dispositions of this type of field ambulance will therefore now conform to the training of units at home, in so far as the nature of the country permits.

These notes, based on the four-section type of unit, may require modification in dealing with the present establishment.

It is proposed to group the notes under four sets of activities, which form a natural sequence, namely: (*a*) Training; (*b*) on column; (*c*) in camp; (*d*) in action.

In actual fact, we were extremely lucky in gaining experience in this very sequence; a prolonged period of complete peace on that part of the frontier allowed us to concentrate on training ourselves, our Indian officers, our British and Indian other ranks, and our animals. This was followed by a repeated series of columns and camps, culminating in a series of small actions, in which the unit was thoroughly tested.

Very different has been, and often will be, the experience of those who have to deal with field ambulances, which are only formed when required. They have just time to collect themselves, their personnel, equipment, animals and vehicles, and then find themselves cast into a brigade or other formation, which is composed of regular or permanent units. After a short period of concentration, possibly one week or perhaps even only two days, they find themselves called on to function as a going concern, responsible for all the medical arrangements of a force advancing into difficult hostile country; for evacuating sick and wounded; and for arranging and super-

vising the sanitation of units, which are busily engaged on protective activities, and of collections of labour engaged for road-making or other work.

There is little time then for training in the various ordinary duties of field ambulance work; for training in stretcher carrying and evacuation down steep hillsides or narrow ravines; for training in water duties, loading equipment, tent pitching, map reading, inter-communication and signalling; for training reservists in ordinary first-aid and nursing duties, and above all, retraining men to march who have been for years working in hospitals.

It is, of course, an immense compliment to the Medical Services that other branches of the Service, which deal mainly with permanent or formed units, should expect medical personnel to be able to function straight off, at few days' notice, as a going concern, and to be capable of carrying out all the work assigned to them. But it must be pretty harassing for the officers in charge of such field medical units; and full credit should be given to all concerned for the amazing way in which such field ambulances do actually become efficient and fully going concerns after a few days.

A.—Training.

For those who are not familiar with the Indian establishment it may be as well to explain this as a first point.

For officers we have members of our Corps or of the Indian Medical Service. Then the Indian Medical Department provides two categories of sub-officers: assistant surgeons, who are of Anglo-Indian parentage and who have qualified after a four years' medical training; and sub-assistant surgeons, who are Indians with a similar type of training. Two or three British other ranks of our Corps, or possibly from infantry units, are attached for nursing duties. We found one of these men of our Corps invaluable as the N.C.O. in charge of the riding animals.

The Indian Hospital Corps personnel is composed of other ranks up to Havildar (Serjeant) and is of different categories: the ambulance section, nursing section, quartermaster and clerical sections. The remainder belong to the general section or are followers, Class I, consisting of ward servants, cooks, water carriers, washermen and sweepers. Finally, there are followers Class II and private servants, and the syces or grooms of the riding animals for the sick.

A word may be added here about "riding ponies for the sick." Under present arrangements a certain number of riding ponies, or riding mules, is allotted for the purpose of evacuating sick and lightly wounded, or for carrying them during portions of a march. These animals require training and frequent exercise to fit them for the work for which they are intended. On column or in action, one syce or groom can only manage two animals. Extra personnel for this purpose was usually found from the followers of the unit.

Training in march discipline and the actual carriage of casualties are extremely important. Properly trained pairs of animals proved invaluable in getting casualties away from difficult ground and in saving man-carrying power.

To simplify many of the points of training, and to add zest to the procedure, we had a system of monthly intersection competitions. Practically every item of training of *all* ranks in a section was included in this competition, and received marks. Thus, stretcher drill, first aid, packing and loading of equipment, condition of quarters and gardens, delivery of messages over a set course by signaller and runner, certain games, and finally a cross-country run for all ranks, were included in this competition.

These competitions added markedly to the efficiency of our training.

(1) *Marching.*

This was considered one of the first essentials for training. The hastily collected personnel of the newly mobilized field ambulance appear to suffer considerably when ordered to march.

The unit must be able to take its normal place in the marching column, covering twelve to eighteen miles daily; and individuals must therefore be capable of doing this without being exhausted, because, apart from collecing men during the march, the greater part of their work commences after arrival at the next camp.

Therefore, every individual must be thoroughly trained in marching. I would emphasize the "every individual." The individuals who especially require hardening by such training are quartermasters, clerks, syces, private servants, cooks and ward servants. Even newly joined officers, particularly temporary commissioned officers of both Services, require hardening and training in the art of marching, if they are to be fit to do their work.

I remember one such unfortunate, a gentleman from Bengal, who turned out for his first route march in a very tight pair of bright yellow boots and a pair of puttees of local make, put on with a firm, but ignorant, hand. The unfortunate fellow, after easing his aching legs at the first halt outside camp, struggled gamely for six miles and then had to retire home on a pony. Later, with practice, he was of course fully able to take his normal place on column.

It is astonishing what a number of these specialized personnel become foot sore and incapable of carrying on during the first few days of a column unless this training in marching is regularly carried out for all categories and ranks.

For this purpose a weekly or a fortnightly march, eight miles out and then back, proved invaluable; and all the particular categories, mentioned above, were made to take part. Office and storekeeping work should be suspended completely for the purpose. The unit thus becomes trained as a whole, each individual knowing his job and his place for the road if called upon to turn out at short notice.

It is only by this means that the considerable number of followers

contained in a field ambulance can be turned out on column as a well-disciplined marching body.

Regular inspections of socks, boots and feet are essential.

To personnel receiving possibly only eleven rupees per month, a saving of a few rupees on clothing allowance is a great temptation, and only strict supervision of the condition of boots and socks will keep these up to a standard fit for hard marching. Socks kept for inspections may be in good trim; but often those kept for marching resemble the Irishman's description of a net, "bunches of holes joined together with string."

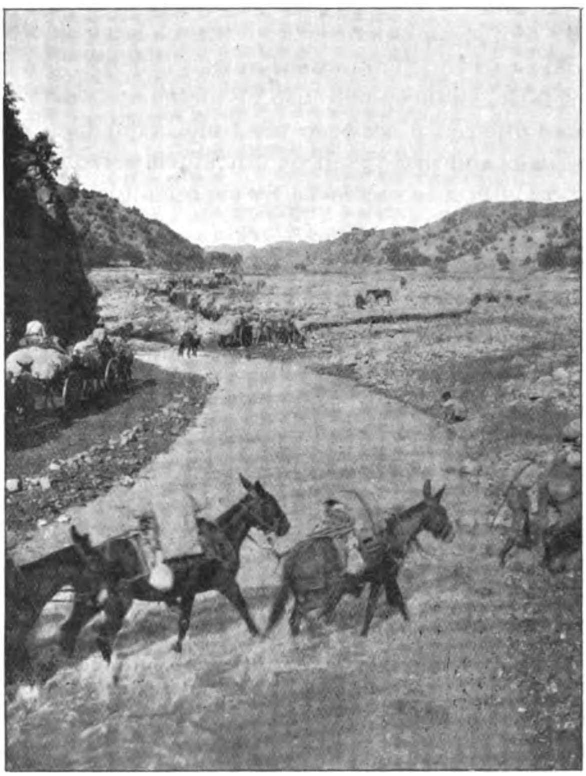

FIG. 1.—A typical road. A wide algad with a road track cleared where possible. Twenty yards to the right of the road is the bed of the stream.

For mountain warfare and for marching over hill tracks, chaplis, or leather sandals, may be the footwear of choice for all ranks. They are considered to be the easiest things for rock work. Where the march is along and through a river bed, they allow rapid drying of the feet and socks after wading. Chaplis, with thick socks and ankle puttees and long hose tops, were found to be the most comfortable and convenient. The question of chaplis is, however, controversial, and recent practice is apparently to insist on the use of the authorized boots and ankle puttees for all ranks.

(2) Stretcher Carrying.

Regular practice with a loaded stretcher is essential for the ambulance section personnel. By this I do not mean mere stretcher drill on the barrack square. This is all right for getting squads to work together and for purposes of competitions. But what is required if efficiency is desired is practice in the carriage of loaded stretchers down from hill piquets, over rocky and difficult paths, and shoulder carriage by squads of six along roads. In some cases carries may be for ten to twelve miles, and only severe training will make stretcher squads able to do this with efficiency when the need arises.

Loading into motor ambulances and into lorries equipped with the Berridge stretcher-carrying equipment (JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, May, 1931) should also be included as part of this training. There is a marked difference between the time taken in loading or unloading by trained squads and that taken by untrained personnel. The comfort of patients is also materially increased by such training.

(3) Other Methods of Carriage of Patients.

Although the work of getting individuals down from piquets falls to the regimental stretcher bearers, yet the ambulance section personnel require training and practice in the individual methods of carriage: hand seat, fireman's lift, pick-a-back and puttee methods. This is partly because they may require to use them, but also because ambulance section N.C.Os. will probably be required for training the regimental stretcher bearers.

Loading into and unloading from camel kajawahs is another method of carriage which requires care and practice, if patients are not to be rather injuriously handled in the process.

As noted already, riding animals for casualties are provided where required, and form a very valuable addition to the carrying capacity of the field ambulance. Loading and unloading from these requires definite training and practice. Syces are only allowed at the rate one per three animals. On column one man cannot manage more than two animals, and during active hill work one man per animal is absolutely essential.

This means that men of the general section have to be trained to the work of managing one or two animals during the day's march. Such training for syces and men of the general section should include mounting and dismounting of patients, keeping their charges under cover, keeping animals well out of the way, with their heads towards the road at all halts on the march, and harnessing and unharnessing.

Good road or column discipline of the animals of a unit is a point by which the general efficiency of any unit is judged by the column commander and by other officers in that column.

(4) Specialist Personnel.

We found it very essential that men alleged to be cooks, ward servants or nursing orderlies should be given courses of training or refresher courses by attachment to the hospital.

In addition all personnel of the ambulance section require training in ordinary first aid, and refresher training in application of bandages, splints and Thomas's splints. This was incorporated as part of our monthly intersection competitions.

Signallers and Runners.—The authorized establishment comprises a few men trained in semaphore. In actual practice we found that semaphore is practically useless in this type of hill work. The distances are usually too great. We also found that it was seldom possible to rely on Brigade or regimental signallers for messages. They are usually too fully otherwise engaged. Messages must therefore be sent by our own unit personnel.

For this reason the field ambulance had eight men fully trained in flag signalling, and eight men constantly under training for replacement of casualties. The ambulance section provided these men, and the Brigade signal section kindly gave the necessary instruction. The average man required three months training. Such extensive training is, of course, out of the question for units which are only formed when required for a sudden minor war, and would only be available in the later stages of such a campaign.

These trained men were never wasted and proved their value time and again on column and in action.

In addition, a number of men, both ambulance and general section, were trained as "runners" for carrying written messages. The delivery of messages at specified points was included as part of our monthly competitions.

While on the subject of messages, it is worth mentioning that medical personnel, officers, assistant surgeons and sub-assistant surgeons, very definitely require considerable training in the writing and despatch of properly constructed official messages. In addition medical officers require practice in the writing of orders for marches and for active operations.

(5) *Map Reading.*

This is a most essential point in which all the senior ranks should be thoroughly trained. Many medical officers and members of the I.M.D. are wonderfully and completely ignorant of map reading in any form, and are completely lost when dealing with the very broken ground, deeply intersected by ravines, which forms the normal feature of this area.

We found it necessary to hold frequent classes in map reading, and to practice the subject by training exercises without troops, by field exercises, sand models and competitions.

Every man who had sufficient education to be able to recognize the markings on a map was trained whenever possible; not so much in technical map reading, as in the practical application of being able to recognize features on the ground, and to be able to reach a given spot, when required.

(6) *Tent Pitching and Use of Equipment.*

This is a duty which is an everyday requirement on column and which can only be learned by practice. Even if tentage for personnel is not taken, tentage for sick is always required; and only practice will train squads to do the job efficiently and economically.

Such practice will cause an expenditure of a certain number of pegs, but the increased efficiency obtained is well worth this expense.

Use of equipment includes such items as operating lamps, primus stoves, water tanks, oil cookers, etc., in which training makes all the difference when these are required for use in any emergency.

(7) *Loading Equipment.*

This sounds simple, but it is only good training and practice which produces the efficiency required on column.

The equipment consists of two portions: That for the bearer sections or companies forms mule pack loads; that for headquarters is loaded in three lorries, or possibly in army transport carts, or may form camel loads. In certain areas the whole equipment, including medical comforts and rations, is carried on an all-mule-pack basis.

In more recent years the column, with which this field ambulance operates, has always been on an all-pack basis.

If lorry transport is supplied, the equipment for this should again be divided into three portions: Tentage for patients will just pack into one lorry; another lorry will hold all the equipment, plus water tanks and two tents, required immediately for opening a M.D.S., or for the ordinary hospital work of camp; the third lorry can just take all the reserve equipment which is not immediately required. This gives the best division, and obviates the need for unpacking a whole lorry load to extract one cholera box.

If army transport carts are used, a similar division of equipment is essential to avoid unnecessary delay or confusion.

All personnel require training in this loading.

Mule pack loading requires special training; loads have to be apportioned equally so as to balance in pairs; all loads have to be roped with loading slings. Only training and practice will make personnel reasonably efficient in this; badly roped loads cause constant trouble, and probable damage or loss on the march. Finally only training will enable squads to load the prepared equipment on to the triple groups of excited and frisky mules without trouble or damage. This, also, was an item of training included in our monthly competitions.

Loading ropes require to be tied tightly with a special knot and the rings for fastening the load on the hooks of the pack saddle to be so fixed that the load will ride easily and comfortably without damage or interference with the pack animals.

(8) *The Use of Personal Equipment.*

Most of the work of officers is done on foot; and undoubtedly for this the infantry pattern of officers' equipment is the most satisfactory. Such an equipment can usually be purchased, part worn, from one of the Indian infantry battalions; and it is well worth while to do so. With it, by the unfastening of one belt buckle, the whole equipment can be shed as one piece off one's shoulders. This was an immense boon on many occasions. With our own pattern of equipment there is insufficient time, at the normal halts on marches, to discard even one item of the weight carried.

The general section men are not provided with any form of coat-carrier. We found it essential to provide these from unit funds.

The equipment of the Indian Hospital Corps, consisting of separate items, such as haversack and water bottle, produces a regular network of constricting bands across the chest and back; and only alteration to a pack-like arrangement gives any real freedom of movement. Moreover in the stooping position, when lifting a stretcher, the items of equipment will always fall forwards in the way. Only the substitution of a pack equipment will remedy this.

(9) *Sanitation.*

Training in this is quite important, both from the point of view of the field ambulance as a unit and for the Brigade.

The ordinary details of field sanitation must be taught to all ranks in the unit, especially to such personnel as newly joined officers, officers' servants, and Indian Hospital Corps personnel, who have served only in hospitals.

For the Brigade, adequate training of sanitary squads must be undertaken to ensure that regimental sanitation and supervision will be reasonably good. This is a point worth stressing with regimental officers, because certain units, who may have seen a good deal of frontier service, imagine themselves to be quite sufficiently trained already, and to be rather above the need for further training.

In addition we found it extremely useful to train our own sanitary personnel in the making of basket incinerators. These we made from bhoosa baling (hoop-iron bands used for binding bales of fodder), and were made of three sizes to nest in one another, and to fit into the bottom of the army transport cart used for conservancy materials. These incinerators we found invaluable as an adjunct to the conservancy personnel of the Brigade.

Unfortunately bhoosa baling is now no longer available as wire is used instead for baling fodder, so other materials have to be found.

B.—On Column.

The expression "going on column" is used for the tour of the Brigade, or composite force of about a brigade strength, through an area or from

one station to another. The marches are of about ten to fifteen miles between camping grounds, and the road varies from a main highway to the shingle-covered bed of a stream, known as an *algad*, winding its way down through the hills, or a rocky mountain track passable only to pack transport crossing from one valley to another.

The column is, for the time being, a self-contained force with advanced guard, main body and rear guard. Protecting piquets are pushed out by the advanced guard to all commanding features on either side of the road. These piquets form the protecting screens, between which the main body moves, and remain in position until they are withdrawn by the rear guard commander.

One or two battalions of the brigade are used up in this manner by the advanced guard commander during the course of the march. The number of piquets required varies with the nature of the ground along the route followed. When one battalion has been used up in piqueting of the route, battalion headquarters remains posted at some central point to control the area. The battalion medical officer forms his R.A.P. usually on or close to the road, near the battalion headquarters; and it is from this spot that the field ambulance personnel have to take over any casualties.

The piquets remain in position until the main body has passed, and then are withdrawn in sequence by the rear guard commander. As soon as they are withdrawn and are no longer required, the personnel concerned reform into their units and rejoin the rear of the main body. It is during this withdrawal of the piquets that trouble is likely to occur, if any hostile tribesmen are present.

Withdrawal of piquets is always carried out with the utmost possible speed to try to avoid casualties, and medical personnel concerned with the rear guard must not hamper the action of the rear guard or the withdrawal of piquets; but must keep well out of the way and evacuate any casualties to the main body as fast as possible.

It is during this withdrawal of the rear guard that tempers are likely to be on edge, especially if the day is far advanced and darkness is approaching. Any delay, or even a semblance of a mistake in getting casualties away, will probably produce a burst of lurid language from those concerned with the rear guard withdrawal.

The field ambulance personnel must be competent, must know their job, and must be capable of rendering all help in getting casualties away from the rear guard, so as to avoid unnecessary delay.

It may be worth mentioning that on ordinary peaceful columns, or more particularly on practice columns and exercises, the speed at which operations and withdrawals are carried out is quite misleading, compared with the speed used when a single shot has been fired. Practice exercises appear to be carried out three or four times as fast as the pace which is possible on an actual " show."

Medical Arrangements for a Normal Column.

(*a*) *Travelling A.D.S.*—The field ambulance commander, as S.M.O. of the column, has to make all the necessary arrangements. The field ambulance will march with the main body, usually in rear of all fighting units.

Two detachments to form A.D.Ss. are required. One with the advanced guard and one with the rear guard; if a detachment with the rear guard can be called an A.D.S. These really form travelling A.D.Ss., or bearer parties.

We found that as a rule the most convenient detachment was composed as follows: Three stretcher squads, with minor medical and surgical equipment and water; four or six riding ponies for sick; two runners or two signallers; one medical officer, one assistant surgeon or sub-assistant surgeon. These were definitely detailed and attached to the advanced guard and rear guard.

In both cases, the medical officer in charge detailed one stretcher squad to report to, and remain in touch with, the medical officer of the advanced or rear guard battalion, as the case might be. This stretcher squad formed his connecting link; and was replaced by a fresh squad as soon as the first had brought in a casualty.

The advance A.D.S. marched in rear of the R.A.P. of the advance guard battalion; and the rear guard A.D.S. marched in front of, but keeping in touch with, and under the command of, the rear guard.

By this means field ambulance personnel were available near each end of the column to take over casualties, and relieve the regimental personnel and medical officer.

(*b*) *Difficulties of Intercommunication.*—If the column is using an algad or a mountain track, it is usually extremely difficult, sometimes impossible, for detached parties, such as stretcher squads, to pass up or down the column while it is on the move; especially against the stream of transport, pack mules or camels. It is for this reason that we require the two A.D.Ss.

It may be as well to emphasize this difficulty of intercommunication. On main roads it may be reasonably easy to pass from the advance guard to the field ambulance at the rear of the main body, or even from the rear guard to the field ambulance. But in algads or on mountain tracks passage from one end to the other of the column is often extremely difficult. The two A.D.Ss. therefore become separate entities to a large extent, and have to rely mainly on their own resources for carrying casualties, until opportunity arises to gain touch with the M.D.S. It was for this reason that definite detachments were always detailed at the beginning of a march.

(*c*) *Sick Casualties in the Column.*—Orders should definitely be laid down that sick on the line of march should be placed at the right of the road, where they can readily be seen. These can be picked up by the field ambulance, or the rear A.D.S., as it marches past.

One N.C.O. should be specially detailed to watch for these patients in

case they should be mistaken for the numerous detached men on the road, and so be left until the arrival of the rear guard.

I can recall certain heated episodes on the Luargi Narai Track to Datta Khel when casualties had been placed behind rocks, etc., so that they were not noticed until the rear guard A.D.S. reached them ; and there was delay in getting them forward again to the M.D.S.

(*d*) The motor transport, if in use on road columns, usually moves in bounds within the length of the column, between the rear of the main body and the front of the rear guard.

It is as well to arrange that one or two motor ambulance cars are at the rear of the motor transport, or move separately behind it. This allows the rear A.D.S. to overtake and get in touch with them ; so that casualties picked up by the rear guard can be put straight into the motor ambulance cars, treated and made comfortable for the remainder of the march until camp is reached.

For this reason these motor ambulance cars should be equipped with water and some simple medical comforts such as milk, bovril or the like, when a long and tiring journey is to be expected. Except on the main roads it is impracticable for a motor ambulance car, when fully loaded, to rejoin the main body of the field ambulance.

(*e*) *Water Party and Colour Party.*—Column orders include details of camp colour parties for each day's march. These parties march, under supervision of the Staff Captain, in rear of the advanced guard as a small body of details from each unit in the force. For the field ambulance one N.C.O. and two men, with the flags for marking the camp site, are sufficient.

The function of these parties is to be present when the Staff Captain is laying out the new camp site, and to mark with their flags the boundaries of the space allotted to their respective units. A good N.C.O. (Naik) should be detailed for this, who will not be pushed from portions of the allotted ground by personnel of other neighbouring units. A good camp colour party, with the assistance of the personnel of the forward A.D.S., should be able to have the allotted ground cleared of stones, and the sites for the various portions of the camp marked and prepared ready for the field ambulance when it arrives with the main body.

The water party should be detailed at the beginning of the column and kept as far as possible for this duty for each day's march. We usually had one sub-assistant surgeon and two men who were thoroughly trained in water clarification and chlorination. They require a Horrocks box and sufficient alum and bleaching powder to deal with the first filling of the water tanks. This water party joins and marches with the "sappers' " water party at the rear of the advanced guard. This sappers' party has all the appliances for opening up the water point at the new camp site; pumps, canvas tanks and digging implements loaded on an A.T. cart or pack transport.

A description of the water point will be given later under camp duties.

(*f*) *Cleaning of the Old Camp Site.*—The O.C. Field Ambulance, as S.M.O., or one of his officers specially detailed, should remain at the old camp site with the Staff Captain and the camp cleaning squad of sweepers after the departure of the main body to see that the whole camp site is left in a thoroughly clean and sanitary condition. The sweeper squad is usually composed of one or two sweepers detailed by each unit for the purpose, together with a portion of the conservancy sweepers of the column, controlled by a Jemadar sweeper. Units are responsible that their own lines are left clean, and where this has not been done note should be taken for subsequent action.

Places which require special attention are the sites occupied by small units : Veterinary hospital, supply depot, signal units, brigade headquarters, institute contractors, and followers' latrines.

As soon as the site has been sufficiently cleaned, the sweeper squad marches off, and the Staff Captain is informed. He informs the rear guard commander, who then begins to call in the camp piquets and to withdraw his rear guard.

The S.M.O. can then rejoin his unit or proceed to Brigade headquarters, as the case may be. It is therefore essential that he should be mounted. We found that it was also necessary to mount one ambulance orderly and keep him as a mounted orderly and horse holder always with us.

(*g*) *The New Camp Site.*—The S.M.O., or an officer detailed for the purpose (the Officer in Command of the advanced guard A.D.S. can do this), proceeds forward with the Staff Captain and a sapper representative to the new camp site, as soon as the advanced guard commander has secured the area with piquets.

The Staff Captain then proceeds to lay out the camp site; details as to siting of the water point, latrine areas, cooking areas, animal standings, slaughtering places and manure disposal are arranged in consultation with the S.M.O. and the sapper officer.

It is as well to remember that, although the camp *may only be* for one or two nights, it may have to be occupied for several weeks, and that it is better to site each of the above-mentioned areas correctly from the beginning than to have to change them after a day or two.

The performance of these duties shows again that the S.M.O. requires to be mounted, as he has to make his way from the rear guard at the old camp to be present with the advanced guard for the laying out of the new camp site.

The water point requires special attention. The probabilities are that there is only one practicable site at any one camping ground, and that the sappers will be the first to utilize the right place. But, as S.M.O., we have often found that certain points require attention immediately, viz. guards over the watercourse, at and above the point of supply, to prevent the watering of horses, mules and camels, washing and bathing, etc., before normal camp discipline comes into being.

The syces and grooms of Brigade headquarters and the gunners are particularly apt to be offenders in the matter of fouling the best water supply.

(*h*) *Prevention of Heat-stroke and Effects of Heat.*—In addition to the ordinary precautions for the prevention of effects of heat, it may on occasions be necessary to form travelling heat-stroke centres.

We found that this could best be done by equipping one motor ambulance car as a heat-stroke station with ice (one maund can be carried), plenty of water kept cool in chaguls (canvas containers), fans and the necessary drugs. This motor ambulance car can travel as one of those centres in touch with the rear guard.

At times and in places where heat is great, it is just as well to make sure that the ordinary methods of prevention of heat effects are really carried out as far as the situation permits. The "G" staff may be inclined to force the pace, or to ignore ordinary preventive measures; and regimental officers may not realize, or may have forgotten, points which make all the difference in the prevention of the effects of heat.

Therefore advice or instructions by us may be really necessary on such occasions, to ensure that unnecessary casualties due to this cause are prevented.

(i) *Temporary Halts.*—All personnel should be properly formed up on the left of the road before falling out. One stretcher squad should be detailed to stand by, ready for urgent calls, because it is often at the halt periods that a message comes in that a man has collapsed and should be taken over by the field ambulance. The remainder of the men and officers should definitely be made to rest.

All animals, riding ponies, mules and chargers should be halted well over to one side of the road, and turned facing inwards, with heads towards the road. Attention to this detail will save one from many a heated word from the Brigade Commander and others, who may be trying to pass up or down the column.

This detail of animal management and correct disposal of all personnel and impedimenta of the unit is one of the points by which others judge the discipline and control of a unit. Nothing is more irritating and gives such a bad impression of the discipline of a unit to those who have to pass up or down the column than to find animals, men and impedimenta repeatedly blocking the way.

The S.M.O. of the column gets a considerable experience of this difficulty when passing from rear guard to advanced guard or when reporting to Brigade headquarters.

Strict road discipline is therefore a point to which it is well worth paying attention for our own unit, and consequently requires special attention during periods of training.

(*To be continued.*)

CYSTICERCOSIS (*TÆNIA SOLIUM*).

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AND

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(*Continued from p.* 306.)

VIII.—Symptomatology.

The symptomatology of this condition is both varied and variable. A wide variety of symptoms may be produced not only in different patients but even in any one patient from time to time. It is extremely difficult to discover the date of the actual infestation of the body with the larval form of the parasite. While during the early stages the patient may have shown no symptoms of any kind, many have a record of admissions to hospital for fever, general malaise or myalgia, three or four months before the onset of the first nervous symptoms. It appears, therefore, that muscular pains and slight unexplained fever may occur during the stage of invasion. In several of our cases the first symptom was severe headache. The disease is caused by a parasite the very existence of which depends on causing as little disturbance to the host as possible; this it is remarkably successful in doing; a patient may have, for instance, hundreds of cysts in his muscles without ever having been aware of their presence, having noticed no pain or weakness at any time. It is not as a rule until the parasite dies that any serious symptoms are produced. The number of parasites that may settle in the tissues in any one patient and the situations they may occupy varies widely; in addition they may die singly or in groups, and these facts account for the variability in the symptoms in evidence at any one time. The cysticerci seem to have a distinct preference for developing in the brain, muscles and subcutaneous tissues. In the muscles they produce, as a rule, no symptoms, in the subcutaneous tissues they may appear as palpable nodules and in one case they became acutely painful at intervals when the patient was pyrexial. The important symptoms are those produced by the parasites in the brain.

In the large majority of our cases some form of epileptic attack occurred; quite frequently the first attack was followed by a period of freedom from symptoms lasting from a few months to one or two years, but following this, very few were free from fits or other nervous manifestations for any considerable period. One patient, however, had a series of fits lasting some hours, then no fits for two years, followed by a second series of fits, and

[illegible] years after. The [illegible] is one of a major epileptic character, but minor seizures and [illegible] are quite frequently seen, and these may be completely indistinguishable from idiopathic epilepsy. Epileptic fits are not invariably present, and the variety of symptoms that may be produced can be gauged from [illegible] list of diagnoses extracted from the medical documents of these patients: Headache, [illegible], effects of [illegible], [illegible] and [illegible] encephalitis [illegible], [illegible] paralysis of the [illegible], dementia [illegible], [illegible] melancholia, [illegible] hysteria and neurasthenia. The great majority had been diagnosed as epilepsy at one time or another. In two cases [illegible] subcutaneous cysticerci had been diagnosed as neurofibromata.

A symptomatic classification such as has been adopted in the past is very misleading. A case of cysticercosis may show such a variety of symptoms at different times that it might be classified differently on several occasions. Symptoms may be produced by any individual cyst that settles in some position in the body where it is likely to cause disturbance by nature of its situation; this applies especially to cysts in the eye. Two of our patients had been operated on and cysticerci removed from the eye. In one case a cysticercus was found at the bottom of a discharging sinus in the region of the knee-joint.

Many patients notice the presence of subcutaneous nodules, and in others they are found to be present although the patient denied all knowledge of them until they were pointed out to him. One patient had never noticed any nodules until he found that he caught the string of his boxing glove round a nodule on his wrist. Another had noticed one nodule on his forehead for some time, but was completely unaware that any others were present, although thirty were easily found when he was examined.

To summarize, in following the evolution of the parasite, one can divide the symptomatology of cysticercosis into three periods:—

(1) *Phase of Invasion.*—This corresponds to the passage of the hexacanth embryo through the wall of the stomach and its migration into the tissues. There are usually no symptoms, though many of our cases have developed fever and vomiting with general malaise, or vague muscle pains, about three months prior to the first fit. It is extremely difficult to date the original infestation.

(2) *Phase of Development.*—The development of the hexacanth embryo into the cysticercus. This period is also indefinite, as man is not the normal host, and figures taken from the period of development in the pig may be misleading. In the pig, this period is two to three months. This phase may evidence itself by pains in the muscles, headaches, etc.

(3) *Clinical Phase of Full Development with Death of the Parasite.*—This may manifest itself by mental and nervous symptoms, fits, or presence of subcutaneous nodules. It is only during this third stage that diagnosis is likely.

IX.—Pathology.

A proper understanding of the symptomatology of this disease is only possible from a study of its pathology, which goes far towards making the variation in symptoms comprehensible. Colonel MacArthur was responsible for this work which gives a new conception of the pathogenesis of this disease. Nearly all the subcutaneous cysts removed for diagnosis have been found to contain dead parasites, shown by the fact that the scolex does not become evaginated of its own accord when placed in warm saline solution and cannot be evaginated by digital pressure, the neck becoming adherent to the surrounding cyst wall after death. There was one exception to this general finding, a living parasite being found in a cyst that had been situated so superficially in the skin as to be palpable in an undistended state quite unlike the tense nodule usually found in these patients. Normally the cysts are impalpable at this stage, for it is only after the death of the larva which is followed by an increase in the fluid content of the cyst that they become distended sufficiently to form palpable nodules. Absorption of the fluid may take place after a varying interval when the cysts again become impalpable. This phenomenon accounts for the "migration" of the parasites described by some authors. The only time that the parasite moves round the body is when passing through the intestinal wall and circulating in the blood-stream, the apparent migration being due to parasites dying singly or in groups, forming palpable nodules which are subsequently absorbed and give the appearance of "new" cysts elsewhere following the death of other parasites.

Similar changes take place in the parasites in the brain and these have been described by Colonel MacArthur and also summarized in the account of the investigation already published by us in the *Quarterly Journal of Medicine*. It is suggested that in the early stages cysticerci in the brain usually cause little or no disturbance in spite of the neuroglial sclerosis surrounding them; that after the death of the parasite degeneration commences, and the tissues around also undergo active degenerative change with cellular infiltration; later a wall of sclerosed neuroglia may be formed round the degenerated necrosed area. Areas in these three stages have been demonstrated in the brain of a patient who died from cysticercus epilepsy and it is thought that the necrosed areas surrounded by sclerosed neuroglia represent those cysts that have caused fits in the past, that those undergoing active degeneration were the cause of fits at the time of death and those undegenerate cysts simply surrounded by a wall of sclerosed neuroglia were potential causes of further fits had the patient survived. Cysticerci that are very superficial in the brain substance may give rise to a secondary meningitis (fig 3).

Calcification may occur in cysts after death of the parasite, but is seldom of a density sufficient to be demonstrable radiologically until at least four or five years after infestation, its time of onset depending mainly on the

longevity of individual parasites. It commonly commences in the scolex and in some cases a calcified scolex has been found lying free in the cyst fluid. In most cases calcification follows some degree of absorption

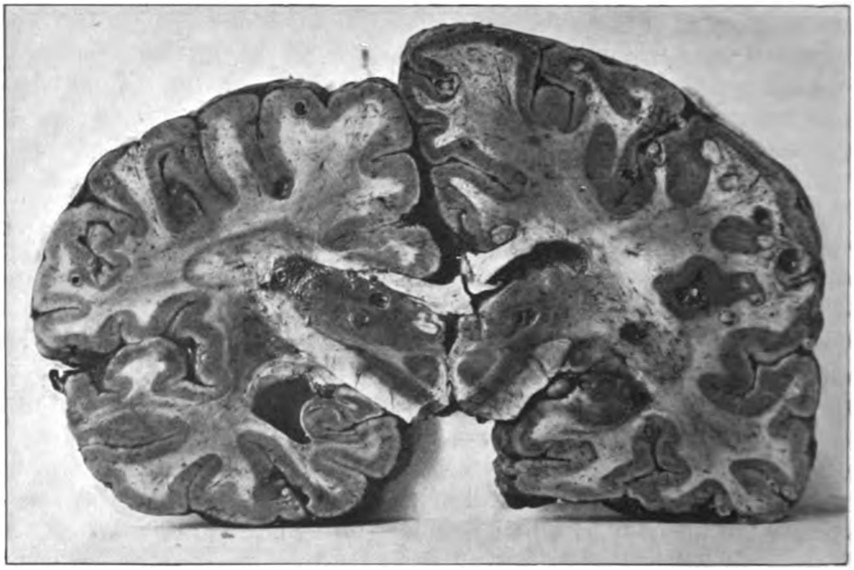

FIG. 1.—Photograph lent by Mr. Hugh Cairns, of section through the brain showing cysticerci embedded mostly in the grey matter close to the surface.

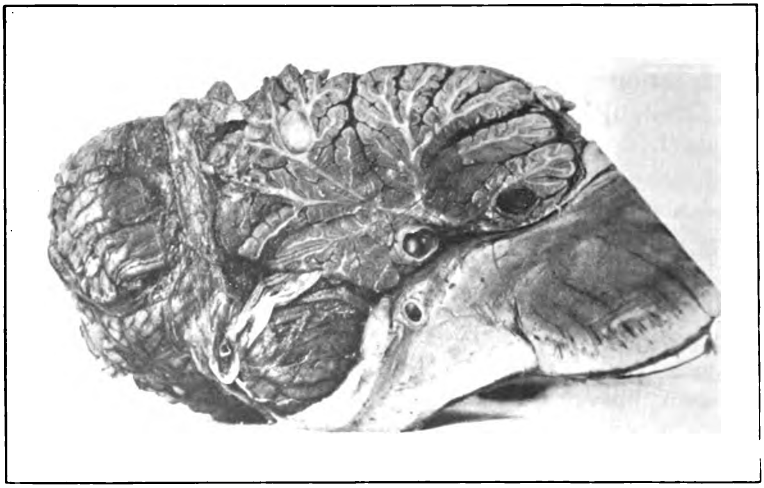

FIG. 2.—Photograph lent by Mr. Hugh Cairns, showing cysticerci in the cerebellum.

and in some cases the cyst may pass through a stage of caseation. The shape of the cyst depends on the pressure of the tissues in which it lies so that the majority are elongated to some extent and lie in the plane of the

muscle-fibres. Calcification of cysts in the brain is less common and tends to occur at a later stage than elsewhere and in most cases it is the scolex only that shows evidence of calcium deposit. Variations in situation, pressure exerted, absorption, caseation, degree of calcification, and the part of the cyst calcified at the time of the examination accounts for the X-ray appearances to be described later.

Many conditions producing local lesions of the brain may result in epileptic fits; these include tumours, abscesses, tuberculomata, gummata

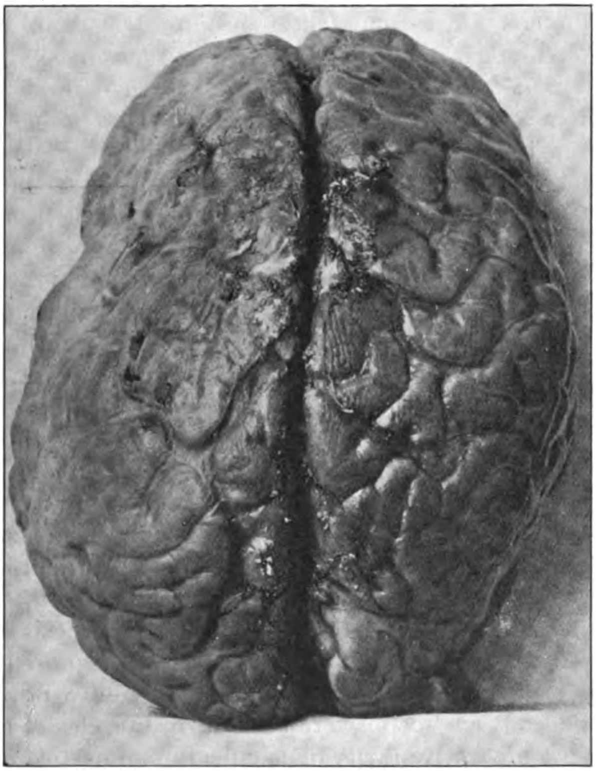

FIG. 3.—Photograph lent by Mr. Hugh Cairns, showing meningitis secondary to cerebral cysticercosis.

and cysts. The late Sir Percy Sargent stated that while any of these lesions may constitute the starting point of an epileptic attack it must not be forgotten that there is no gross lesion whether traumatic or otherwise which necessarily causes fits; on the contrary, the proportion of patients with any such lesion who develop fits is small. He found, however, the frequency with which fits were associated with tumour of the brain to be striking; in 270 of his cases of brain tumour exclusive of cerebellar and pituitary cases 30 per cent exhibited fits of a local character. He formed the opinion that the nearer the tumour or the surrounding area of cerebral softening approached the central sulcus the more likely were fits to occur.

The actual production of any epileptic attack has long been a subject of speculation. Hughlings Jackson, 1864 (quoted by Collier), theorized that every epileptic attack had a local starting point in the cerebral cortex and that the difference between the general attack and the local attack was determined by the power to spread and by the rapidity of spread of the disturbance of function to other parts of the cortex. He regarded the epileptic event as a loss of function in the primarily disturbed higher regions producing unconsciousness, with a release of function in the lower regions resulting in active manifestations such as convulsion and evacuation from the sphincters. A second factor is almost certainly necessary in producing the epileptic attacks resulting from a lesion of the cortex, and this is probably a metabolic one. A theory, an account of which is given by Collier (1934), is that all epileptic phenomena, whether of idiopathic epilepsy, or from lesions of the brain or from extrinsic poisons, uræmia, eclampsia, rickets, etc., are of the same nature and due to some dyscrasia of metabolism. Men, this theory suggests, may be divided into three groups in this connection: Firstly, those in whom, from stability of metabolism, this dyscrasia will not occur and neither lesions of the brain nor uræmia or any other agent will produce epilepsy; secondly, a group of potential epileptics in which lesions of the brain, uræmia and other causes may provoke epilepsy; and thirdly, those in whom the necessary dyscrasia is constantly present, the frank idiopathic epileptics whose fits are determined by an increase of the metabolic disturbance. It is now thought possible that an unstably held acid-alkali balance forms part of this metabolic dyscrasia and that attacks occur when the instability allows a hyperalkalosis. It has been noted that the one disease which never seems to occur with epilepsy is diabetes, and the treatment of young epileptics by the use of a ketogenic diet is said to be of definite value.

It is not necessarily every patient with cysticercosis that develops epileptic attacks, in fact a few of our patients were diagnosed on skiagrams taken for some other purpose and state that they have never had a fit of any kind. Numerous cysticerci were seen in the muscles of these patients but owing to the comparative rarity of calcification in cysticerci in the brain it was impossible to prove definitely whether larvæ were present in the cerebral hemispheres. We have found patients' statements with regard to a history of fits to be unreliable in some cases as this admission may prejudice their chance of employment (one patient who denied ever having had a fit was later found to have been discharged from the Army previously with epilepsy), and it appears that a very high percentage of patients suffering from cysticercosis do develop fits or other nervous manifestations at one time or another. It is possible that this high incidence may be due to some toxic effect which, unlike most other intracranial lesions, may be produced by the cysticercus.

(To be continued.)

DUTIES OF A QUARTERMASTER'S DEPARTMENT IN PEACE.[1]

By Lieutenant and Quartermaster J. G. EVES, M.B.E.,
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The subject of this lecture deals with the duties in a Quartermaster's Department in peace. I propose to discuss the subject generally and not go into too much detail as that would take up a good deal of time.

I think the duties might be summarized under the following general headings :—

(1) Charge of the buildings, quarters, barrack rooms and enclosures of a military hospital and company, R.A.M.C., and the fixtures contained therein.

(2) Arrangements for the supply and maintenance of, and the accounting for, all equipment, barrack, medical and ordnance.

(3) The indenting and accounting for : (*a*) Diets and extras ordered for patients in hospital ; and (*b*) rations for the R.A.M.C. personnel.

(4) The submission of indents for fuel and light, disinfectants, etc., and accounting for them.

(5) Hospital charges.

(1) Buildings, Quarters, Barrack Rooms and Enclosures.

I shall deal with each heading separately and commence with the charge of buildings, etc.

All buildings, quarters, etc., are taken over from the Officer i/c Barracks by the Quartermaster on behalf of the O.C. and held on charge by the O.C. Unit. A statement of all the rooms, etc., contained in the barrack and hospital buildings is detailed on Army Form G. 1062. This form is made out in duplicate and signed by the O.C. Unit and the Officer i/c Barracks. One copy is kept by the O.C. Unit and the other by the Officer i/c Barracks, and the statements are verified annually. This verification takes place just before the Officer i/c Barracks carries out his annual inspection.

Once the O.C. Unit takes over any building he is responsible for its care and maintenance and deals direct with the Divisional Officer, Royal Engineers, in this connection.

Each room in a building or quarter is generally provided with an inventory of R.E. fixtures, and one of the duties of a Quartermaster, in so far as the hospital and barrack buildings are concerned, is to make a periodical inspection of them and where damages or deficiences are noted

[1] A winter-training lecture delivered at the Military Hospital, Imtarfa, Malta, on December 19, 1934.

to fix if possible individual responsibility. In a place like a military hospital where the occupants of the various wards and departments are continuously changing it is often impossible to fix the blame on any particular person.

Where loss or damage can be traced the matter is reported to the D.O.R.E. on Army Form P. 1923 and the individuals are charged.

It may be well to mention at this stage that as a general rule the occupants of War Department buildings are regarded as being in the position of tenants of a civilian landlord who expects all broken glass to be made good at the expense of his tenants. Glass is not replaced in War Department buildings at the public expense as a matter of course on the grounds of damage by storm, or that the persons who did the damage are unknown. Normally the unit must collect the cost from someone or suffer the loss.

On the other hand the regulations do relax to some extent in this respect; for example, at some stations gales spring up with considerable force with little or no warning. Doors, windows and fanlights bang to and the electric lights swing about with consequent breakages of window panes and opal lamp shades. Doors and windows when open should, however, always be secured by the hooks and eyes which are generally provided for the purpose, so it is always difficult to get charges through on that score, but cases do arise when such breakages occur through unavoidable circumstances, and when this happens we report the matter on Army Form K. 1306, if urgent, or on Army Form K. 1308, if not urgent, to the D.O.R.E.

On these forms we show the nature of the repair required and give a statement of the circumstances in which the damage occurred, the C.O. adding a certificate to the effect that he is satisfied that all reasonable precautions to prevent damage were taken, that is, windows, doors and jalousies were at the time properly fastened. If the D.O.R.E. agrees, all well and good, the damage is repaired at the public expense. Sometimes, however, he does not agree, in which case the C.O. has the right of appeal to headquarters.

There are many losses and damages to R.E. fixtures in a military hospital which are not due to the elements and which, on the other hand, cannot be traced to individuals, and these have to form the subject of a proportionate charge against units whose sick have been treated in the hospital during the period in which the losses or damages took place.

These items are generally dealt with once a quarter and the procedure in brief is this:—

Particulars of the various losses or damages are given in detail on Army Form P. 1923 and sent to the D.O.R.E. who carries out the replacement or repair and reports the cost to the O.C. hospital.

The O.C. hospital (actually the Quartermaster) divides the cost amongst the various units concerned according to the number of their men who have been under treatment and sends the detail back to the D.O.R.E. who then sends it to the Garrison Adjutant and he notifies the units in garrison orders the amounts to be paid to the public.

So much for losses and damages. Now a few words on repairs.

There are two classes of repairs, namely, normal and urgent.

Urgent repairs are reported immediately on Army Form K. 1306 and are generally confined to repairs affecting water, gas and electricity. There are exceptions to this; for example, if the key of the ward medicine cupboard is lost and the cupboard cannot be opened, then action has to be taken straight away. In this respect the Quartermaster has to use his discretion.

Normal repairs are reported monthly on Army Form K. 1308 and the repairs are carried out by the R.E. as and when the labour at their disposal permits.

I shall now mention a few of the more important things to watch when taking over any class of building.

For example, lavatory basins, water closet pans, baths and sinks. These are expensive items which easily get damaged, so it is well to make sure that they are sound before taking over.

Keys are another source of trouble; they are constantly getting lost, and, as it is difficult to fix the blame, it is as well to ensure that all locks have properly fitting keys. Yale locks are provided with three keys, and locks to stores generally have two. Duplicate keys for ordinary door locks are not provided. There seems to be a popular impression that the Quartermaster holds a duplicate key for every door, but this is not so. If the key to an ordinary locked door is lost the only thing the Quartermaster can do is to call in the help of the R.E.'s to open it, and this is usually managed by force.

Make a note of broken or cracked window panes. See that the individual from whom you are taking over the building accepts responsibility for their replacement.

You will find in taking over buildings, quarters, etc., that all the R.E. fixtures are not shown on the inventory boards, but only those which could easily be removed. Such items as sinks, lavatory basins, water closet pans, water cisterns and pipes are not shown.

It may be interesting to know what you can have done in the way of redecoration, for instance, to your quarters. The external painting of wood and iron work may be done every four years at home stations and every two or three years at stations abroad. Internal painting is normally done once in eight years.

In the case of a change in the occupancy of officers' quarters, internal painting up to one-eighth and external painting up to one-fourth of the total respective costs of these periodical services may be incurred for each year that has elapsed since they were last done.

In the case of all quarters, one coat of distemper may, if necessary, be applied on change of occupancy provided that not less than one year has elapsed since it was last done.

Rooms in which infectious diseases have occurred may (after disinfection)

be redistempered and repainted on the certificate of an officer of the R.A.M.C. that the work is necessary.

In addition to the periodical inspection made by the Quartermaster, half-yearly inspections are carried out by the Royal Engineers for the purpose of noting and carrying out maintenance services. The dates of these inspections are published in garrison orders.

There are actually two classes of R.E. Services, namely, Capital Services, which comprise new works and additions, and Maintenance Services, which include repairs and periodical services.

These are further split up into Part I, Part II and Part III Services.

Part I deals with services costing £2,500 and upwards, and do not affect us very often.

Part II deals with new works likely to cost less than £2,500. Under this heading I might mention that in March each year the D.D.M.S. calls for a list of Part II Services which the O.C. wants carried out and the items have to be put down in order of priority. As I have just said these comprise new works or additions, for example, additional buildings, additions to existing buildings, structural alterations to wards and departments.

We do not, of course, always get what we ask for, as much depends on the urgency of the services and the availability of funds.

(2) Equipment—Barrack, Medical and Ordnance.

This heading deals with the supply and maintenance of, and accounting for, all equipment, barrack, medical and ordnance.

(a) *Barrack Equipment.*

Barrack equipment, as you no doubt know, includes furniture, linen, bedding, hospital clothing, fire appliances, electric bulbs, etc.

All such equipment for use in a hospital or in barrack rooms is provided by the Officer i/c Barracks in accordance with the scales laid down in hospital or barrack schedules. Hospital schedules deal generally with the wards and various departments which go to make up a military hospital, and barrack schedules with such places as officers' and soldiers' quarters, messes, nursing sisters' quarters, churches, schools, libraries.

Each of the wards, departments, rooms, etc., in these places, is invariably provided with an inventory board, on which is shown the articles held on charge. In addition, in the case of hospitals, Army Book 126 A., more commonly known as the "long roll," is also maintained, and this is kept in the Quartermaster's office. A copy of this long roll is also held by the Officer i/c Barracks. This long roll is actually a complete inventory by wards and departments, of the whole of the barrack equipment held on charge by the hospital. No alteration can be made to the entries in the long roll or to the entries on the inventory boards except by the Officer i/c Barracks or his representative, and each alteration has to be initialled by one of them.

Issues in excess of the scales laid down cannot be made without the approval of the G.O.C., and even then they are subject to review every six months.

Apart from the scale of stores allowed specifically for the various wards and departments of a military hospital, hospital schedule No. 24 gives a list of additional equipment which is allowed for the hospital as a whole. This equipment is held on charge in the linen store, and includes such items as linen and bedding, crockery and cutlery, patients' hospital clothing, measure glasses, hot-water bottles and the various other articles which a ward needs to hold on loan according to its requirements.

In wards nursed by the Q.A.I.M.N.S. the matron takes over and is responsible to the Quartermaster for the whole of the bedding and equipment held on charge. A bedding book, A.B. 54, is maintained, and this is signed monthly by the matron.

The bedding and equipment in wards and departments not nursed by the Q.A.I.M.N.S. are held on charge by the N.C.Os. or orderlies concerned.

In addition to these there are also held on charge items purchased either under the official shilling-a-bed fund or from private funds. The shilling-a-bed fund is authorized by Allowance Regulations. There are, for example, 100 equipped beds in this hospital and each financial year we are allowed £5 to spend on articles which are likely to give greater comfort to the sick, but which are not authorized by schedules (hospital). The bills are submitted to Headquarters for approval, and payment is made by the Command Paymaster.

It can, I think, be readily appreciated that to keep the equipment straight, frequent inspections are necessary, particularly in the military hospital where there are items on charge under four headings, namely :—

(1) The normal barrack equipment for the ward or department.
(2) Linen and bedding.
(3) Other articles on permanent or temporary loan from the linen store.
(4) Articles purchased from the shilling-a-bed and other funds.

A further duty of the quartermaster in connection with barrack equipment is to arrange for its exchange when it becomes unserviceable or requires repair. This includes the changing of chipped and cracked crockery and burnt out electric bulbs. These exchanges are usually made once a month, and Army Form F. 765 is used for the transaction. Articles of barrack equipment for exchange are not accepted into barrack store unless they are in a clean condition. Chipped and cracked articles of crockery are not normally accepted unless their condition is such as to make them dangerous for further use.

Electric lamps can be exchanged provided only the filament is burnt out. If they are broken in any way then the matter becomes one to be dealt with according to circumstances, that is, on Army Form I. 1229 if an accidental breakage, or on Army Book 51 if chargeable against an individual.

Whilst on the subject of barrack equipment I must not overlook the most important function of the linen store and that is the procedure for the exchange of soiled linen, clothing, etc., for clean articles. Ordinarily this is done at the barrack stores once a week, and Army Book 200 is used for the purpose.

The procedure briefly is this :—

Army Book 200 is prepared by the sister or orderly in charge of the ward, giving details of the numbers of clean articles of linen, bedding and clothing required in exchange for soiled items. This is taken to the linen storekeeper who issues the clean articles and retains the copy of A.B. 200 until the equivalent number of soiled articles has been received. The soiled linen from the wards and departments is collected in the foul linen store and is exchanged once a week with the Expense Store Accountant.

The linen storekeeper in carrying out these exchanges has to keep a sharp look out for any articles which are, for example, not of Army pattern, badly stained, or which in any way appear to have been used for an improper purpose. For instance, in this hospital just recently we made the painful discovery that medicine cloths had in some cases been used for washing the floors, and dusters for cleaning brass work. This sort of thing raises complaints from the laundry people, who cannot get the articles clean, and causes considerable difficulty with the barrack department who, quite rightly, raise objections to exchanging them, as articles are, after all, supposed to be used only for the purpose for which they are issued.

It is also the duty of the linen storekeeper to see that the articles received back from the Expense Store Accountant are in a serviceable condition, have been properly washed and are correct in number and description. The transaction between the linen storekeeper and the Expense Store Accountant is also carried out on Army Book 200. These weekly exchanges between the hospital and the Expense Store Accountant are entered into Army Book 175, which is the hospital bedding and clothing account and washing book.

According to regulations the washing book should be totalled up once a month and the numbers of each article of linen and bedding entered on Army Form F. 702 and each article of clothing on Army Form F. 762. (In this Command we do it once a week.) These forms, which actually show all washing transactions throughout the month or week as the case may be, are signed by the O.C. and transmitted to the Officer i/c Barracks.

All articles of clothing, bedding and linen used in venereal disease wards are kept quite distinct both in the linen store and on the washing lists, and the articles have to be disinfected before they are handed over to the Expense Store Accountant for washing. A certificate to that effect is entered on both Army Forms F. 702 and F. 762.

The stocktaking of the linen store is carried out once a month and a stocktaking report (Army Form I. 1227) is made out

This form is completed so as to account for every article held on charge, and the top line of each sheet gives the number of articles under the various headings according to the inventory. Then underneath are shown, for example, articles in the foul linen store, at the disinfector, those covered by accidental breakage certificates, personal charge, articles due from barrack store, those on permanent or temporary loan to wards and departments, on charge to the matron in the bedding book, and in possession of patients in hospital. The total of these items under the various headings when deducted from the number held on charge, represents what should actually be in store on the day of stocktaking. Every item in the linen store is then counted and the result entered on the stocktaking report.

This is a fairly long and tedious job. In this hospital it generally takes a matter of two to three hours to check the linen store.

(b) Medical Equipment.

The scales of medical equipment allowed for the various medical units and special departments of a military hospital are laid down in Appendices 25 to 37 of the Regulations for the Medical Services of the Army, 1932.

In military hospitals of over forty beds this equipment is accounted for in loose leaf ledgers, Army Forms I. 1211 for drugs and Army Form I. 1212 for other medical equipment.

In the case of military hospitals of forty beds and under and other small medical units, a small bound ledger, Army Book 40, is used.

In military hospitals of over forty beds the consumable articles such as drugs and dressings held in the reserve store and all non-consumable articles in possession of the unit are held on ledger charge, but directly consumable articles are issued from the reserve store to the dispensary they are struck off ledger charge. Such issues are supported by dispensary indents on Army Book 30, which form the supporting issue vouchers for the ledger.

In the case of smaller units the procedure is slightly different; the whole of the medical equipment, including that in the dispensary, is held on ledger charge until the end of the year, when that remaining on charge is deducted from the total receipts, the difference between the two being shown as the expenditure.

Medical equipment ledgers are balanced annually on March 31, and forwarded with all supporting vouchers to the local auditor in whose office the accounts are very thoroughly checked and whose observations, if any, are received in due course.

Also at the end of the year a balance sheet of medical equipment is prepared (A.F. I. 1200). On this form is shown the whole of the medical equipment remaining on ledger charge as on March 31. It also gives the expenditure which has taken place during the year divided under two headings, namely, first half year and second half year.

From these returns the D.D.M.S., the local auditor and the War Office are able to see whether stocks of drugs are being held in excess of requirements.

So much for the accounting for medical equipment; the next item is the maintenance of stocks.

Indents to replenish stocks are prepared half-yearly on Army Form I.1209 and submitted to the War Office through the D.D.M.S. of the Command. Normally only such items as are authorized by regulations should be asked for, but where unauthorized drugs or appliances are required and included in the indents, a full explanation of the circumstances which render them necessary has to accompany the demand.

Indents for each half-year should normally be based on the expenditure during the corresponding half of the previous year. For example, if indents are being prepared for the period October 1, 1934, to March 31, 1935, the demand would normally be based on what was actually expended during the period October 1, 1933, to March 31, 1934.

In addition to the above it is allowable to include sufficient to allow of a two months' reserve in the case of hospitals at home and three months' reserve for hospitals overseas.

The purpose of the regulations is to avoid excessive demands and at the same time to prevent the necessity for intermediate indents and this is by no means an easy matter, although the three months reserve for overseas does help.

One of the reasons which makes it difficult to avoid intermediate demands is a sudden run on certain drugs which could not have been foreseen when the half-yearly demand was prepared. This is generally due to changes or new ideas in the method of treatment and often coincides with the arrival of new medical officers.

In such cases, of course, supplementary indents cannot be avoided and these have to be accompanied by an explanation giving the reasons which make them necessary.

In cases of urgency drugs can, however, be purchased locally, but the covering approval of the D.D.M.S. has to be applied for at once. The D.D.M.S. can, of course, refuse to give covering approval in cases where he considers sufficient urgency did not exist to warrant local purchase. The trouble with local purchases, particularly at some stations overseas, is that a much higher price has to be paid, compared with the cost if the articles were obtained from Army sources.

Bills for articles purchased locally are, after approval, passed to the Command Paymaster for payment and the drugs are taken on charge in the ledger.

The replacement of medical stores becomes necessary for various reasons; for example:—

(1) The expenditure of consumable articles such as drugs, dressings, X-ray films.

(2) The replacement of glass articles which are broken by accident or otherwise.

(3) The replacement of non-consumable stores which have become unserviceable through fair wear and tear, have become lost or damaged beyond repair.

The expenditure of consumable stores is, of course, supported by issues to the dispensary on Army Book 30.

The replacement of broken glass articles is either covered by Army Form I. 1229 (Accidental Breakage Certificate), or by personal charges. Clinical thermometers, if written off as a charge against the public, have to be supported by Army Form I. 1230, signed by the D.D.M.S.

As regards non-consumable stores which become unserviceable through fair wear and tear, these are usually collected into store and are brought before a Board of Survey which assembles once a year in October. This Board decides which articles are good enough to be sent for repair and which should be destroyed as no longer serviceable. The proceedings of this Board after approval by the D.D.M.S. form the voucher in support of the articles shown as destroyed and written off charge.

As regards losses or damages to non-consumable stores other than glass articles, these are dealt with in accordance with King's Regulations. If the charge is against an officer or nursing sister, Army Form O. 1680 (Paymasters Debit Voucher) is used; if against a soldier on the hospital staff the amount is paid through the soldier's account and Army Form P. 1963 (list of men placed under stoppages) is used; the write off in the ledger being supported by Army Form P. 1925 (Expense Store Voucher—General Service). In the case of patients Army Book 51 (Personal Charge Book) is used.

In cases where there is doubt as to whether the loss or damage should be borne by an individual, Army Form I. 1230 (Report of Deficient or Damaged Medical Equipment) is completed and submitted to the D.D.M.S. for decision.

In addition to indents to replace items expended, lost, broken, or worn out, we have to deal with items requiring repair. No particular date is laid down for the submission of repair indents. If the article or articles are urgently required an indent is submitted at once, otherwise they are held over until a sufficient number of items has been collected to warrant their dispatch home for repair.

Minor repairs such as grinding, polishing and setting of knives, saws and scissors, hard and soft soldering, repairs to splints and small sterilizers, can usually be carried out at the Army Medical Store, Woolwich, but such items as replating and renewals of parts, repairs to articles made of rubber, vulcanite, or glass, and repairs to the various surgical instruments are carried out by contractors at home.

Repairs to medical panniers and similar articles may be carried out locally in R.A.O.C. workshops or, as an alternative, if this work cannot be done there,

the D.D.M.S. can authorize such slight and inexpensive repairs to be carried out by local tradesmen at the public expense.

What I have said so far deals generally with normal equipment in use during peace. In addition to this, field medical equipment is stored in readiness at certain stations at home during peace for issue to units, medical and others, directly mobilization is ordered.

This equipment has frequently to be inspected and overhauled and a turnover made of the perishable articles to ensure that the equipment when required is in a serviceable condition. At some stations at home, where stores for the large field medical units, such as general hospitals, are held, a special staff is allowed, as the turnover and care of this equipment involves a tremendous amount of work.

This mobilization medical equipment is inspected on January 1 and July 1 each year by a Board of medical officers, and the Board should be composed as far as possible of those detailed for duty with the unit on mobilization.

This equipment is reserved exclusively for the unit to which it is allotted, and no portion of it can be taken into use in peace without specific War Office authority.

(*c*) *Ordnance Equipment.*

In peace time, few transactions are carried out direct with the R.A.O.C., and these are mostly by the Company and concern such items as clothing and necessaries, tentage, instructional equipment for camps, public clothing and the personal equipment of the troops.

Indents for equipment required to complete to scale or to replace unserviceable articles are submitted monthly to the D.A.D.O.S. on Army Form G. 997. This form is also used to indent for materials for the repair of respirators.

For camp equipment Army Form G. 968 is used, and for small arm ammunition Army Form G. 812. As regards camp equipment, if the quantities required are small, Army Form G. 997 may be used instead of the G. 968.

In addition to indenting for ordnance stores, it is sometimes necessary to return them for repair, and in such cases a workshop indent, Army Form G. 1045, is submitted to the D.A.D.O.S. who arranges for the articles to be repaired at R.A.O.C. workshops.

All equipment on charge to a unit is accounted for in the Equipment Ledger (Army Book 253). At home stations, and at stations abroad where there is a local auditor, the ledgers remain open and in use until called for by him for audit.

At stations abroad where there is no local auditor they are balanced up to September 30 in each year and forwarded with all supporting vouchers to the War Office, an office copy of the equipment ledger being kept by the unit.

There is a special Appendix in the Equipment Regulations which gives full instructions for the keeping of equipment ledgers.

I might mention whilst on the subject of equipment that R.A.M.C. soldiers do not take with them their personal equipment when moving from one station to another at home. They only take their anti-gas respirators. When, however, they proceed from home to stations abroad, or vice versa, they take their respirator, haversack, water-bottle and mess tin, but leave behind their white walking-out belt, also their web equipment belt and pack with supporting straps.

Officers and members of the Q.A.I.M.N.S. also take with them their respirators when moving from one station to another. I notice that in a recent order respirators are in future to have an identity disc affixed on which is to be shown the Regiment or Corps underneath the soldier's Army number, or officer's rank and name.

Whilst on the subject of equipment, it might be of interest to mention that an officer on first appointment to the R.A.M.C. receives a free initial issue of camp kit consisting of a camp bedstead, pillow, groundsheet, wash-stand, basin, bath, bucket and chair, also three new brown blankets. This kit is maintained at the expense of the owners.

Members of the Q.A.I.M.N.S. also get a free issue of this camp kit when first ordered on active service.

In addition to this R.A.M.C. officers get a free issue of a pair of binoculars and a prismatic compass. These two items remain his personal property, provided the officer serves four years, otherwise, unless there are some special reasons, they must be returned to store in a serviceable condition, or be paid for.

As regards clothing and necessaries, units are supposed to maintain a sufficient stock to meet requirements for three months.

An N.C.O. or storekeeper and sometimes both (depending upon the size of the Company) are required to carry out the work of the store, which consists in keeping stocks clean and free from such pests as moths, silver-fish or "woolly bear," preparing indents to meet requirements and keeping the transactions posted to date in the clothing ledger.

Indents on Army Form H. 1181 for personal clothing and necessaries on payment, and on Army Form H. 1179 for free issues, are prepared monthly by the Company Officer, and issues to the Company are made by the Quartermaster.

The prices of the articles issued on payment are entered on Army Form H. 1181, and the individual concerned signs for them at the foot of the form. This form is sent to the Regimental Paymaster not later than the 23rd of the month for pre-audit. He then returns it to the Company Commander who charges the amounts against the individuals in the pay and mess rolls, and credits the total to the public in the company account.

Indents for clothing and necessaries are prepared on Army Form G. 997A and are submitted to the D.A.D.O.S. of the area.

All transactions are accounted for in the clothing ledger, Army Book 285. This ledger is closed and balanced at the same time as the equipment ledger, which in this Command is on September 30 of each year. When the ledger is closed a stocktaking board is assembled to count the articles actually remaining in store and the proceedings of the board are recorded on Army Form H. 1164 which accompanies the clothing ledger when forwarded for audit.

Mobilization Clothing and Equipment.—Under the heading of Ordnance Equipment I might say a few words on the system of the storage in peace of clothing and equipment required to clothe and equip reservists who report for duty at the various R.A.M.C. companies at home on mobilization.

The arrangement generally is that these reservists, under instructions from the Officer i/c Records, join for duty on mobilization at the depot and headquarters of the various R.A.M.C. companies at home, and as it is necessary that these reservists should be clothed and equipped immediately on joining, steps have to be taken in peace to store sufficient equipment, clothing and necessaries to enable this to be carried out.

Briefly what happens is this:—

When a soldier is transferred to the Army Reserve a statement giving the size of his boots and measurements of his clothing is sent with his documents to the Officer i/c Records. The Officer i/c Records then forwards it to the O.C., R.A.M.C. Company, to which the reservist is due to report on mobilization.

The O.C. the R.A.M.C. Company is responsible for completing an Army Form G. 1091 for each reservist due to join his company. This form shows in detail the equipment and clothing which have to be issued to the man on mobilization, and gives the sizes of his clothing and boots. When the reservist joins on mobilization this Army Form is handed to him and the articles shown thereon are issued from store, and the reservist signs the form in acknowledgment of their receipt.

In order to keep the sizes shown on Army Form G. 1091 up to date, measurements of reservists are again taken when they come up for training, and any alterations found necessary are made to the above form.

I believe, in the days prior to the Great War, the complete kit of each reservist was kept separate and ready for issue when required, by means of a system of racks which were provided for the purpose.

Nowadays the whole of the clothing and necessaries are held in bulk in the original cases and bales as received from the R.A.O.C. The description, size and number of articles, also the date of packing, are marked on the end of cases and bales, and these are arranged in the store so that the markings can be easily read.

A record by sizes and bales of articles stored for reservists is kept in Army Book 250. Owing to the fact that changes are frequently taking place amongst reservists due to join on mobilization, the sizes of garments have to be reviewed quarterly in order to adjust them to the various require-

ments as shown by the Army Form G. 1091. Clothing and boots of abnormal sizes are only stored where measurements of reservists show that abnormal sizes are necessary. Where it is found that certain men cannot be fitted from stock sizes when joining on mobilization, indents and size rolls have immediately to be submitted to the Royal Army Clothing Department. In the case of special size boots, these may, where necessary, be provided regimentally, provided the cost does not exceed military rates.

A Turnover Book (Army Book 333) is kept by officers who hold mobilization equipment and reservists' kits on charge. Into this book are entered any items which the officer holding the equipment has reason to think may have deteriorated and considers should be specially turned over, irrespective of date of packing or manufacture (normally a turnover is made of articles which have been stored for five years or more), also any articles which may have been superseded by a later pattern.

There is a good deal of work in the care and preservation of reservists' kits; such articles as boots, knives, forks, razors and mess tins require periodical inspection. Boots require to be well dubbined at least once a year, and the eyelets cleaned and smeared with soft soap. Knives, forks and razors should be inspected frequently and wiped with an oily rag at least once every twelve months.

Arrangements should be made to exchange articles found to be defective at periodical examinations.

Clothing and necessaries held for reservists are inspected once a year by the D.A.D.O.S.

The clothing and necessaries are not marked until after issue to reservists.

Mobilization clothing and necessaries are normally accounted for in a ledger, Army Book 284A, and this is balanced and rendered for audit once a year at the same time as the ordinary peace clothing ledger.

Having dealt with duties in connection with the charge of buildings, R.E. fixtures and the various stores and equipment, I think, before going on to the next heading, this might be a suitable moment to say a few words on the general procedure which has to be carried out when a change takes place in the command of a Military Hospital and Company, R.A.M.C.

Buildings and R.E. Fixtures.—Arrangements are made with the D.O.R.E. for a representative from his department to carry out, with the quartermaster, a complete inspection of the buildings and R.E. fixtures on charge. (This inspection does not usually include married quarters which are occupied, as the occupants are responsible for meeting any deficiencies or damages noted on vacation.)

Barrack and Hospital Equipment.—Similar arrangements are made with the Officer i/c Barracks for a representative from his department to carry out a complete check of the barrack and hospital equipment on charge to

wards and departments of the military hospital, and also in the barrack rooms and outhouses, messes, etc., but not occupied married quarters.

Medical Equipment.—It is not necessary for the officer taking over to check every item of medical equipment unless he wishes to. He should, however, at once take steps to test the accuracy of the stock of such stores by comparing certain items with the ledger balance.

There is no object in a new commanding officer wasting much of his valuable time during the period of taking over by checking common and inexpensive drugs, but it is well to check dangerous and costly drugs and the more valuable and important instruments and items of equipment.

A certificate has to be furnished to the effect that he has tested the the accuracy of stocks and has no reason to doubt the general agreement of the stock with the balance as shown in the ledger. This certificate has to be forwarded to the local auditor.

Clothing.—Normally a regimental board is assembled to take stock of the clothing and necessaries and verify the ledger balance; however, if the officer taking over charge considers it unnecessary, the board may be dispensed with, but he is held responsible for the correctness of the clothing taken over and must sign the necessary certificate which accompanies and supports the ledger when sent for audit.

Equipment.—The procedure is the same as for clothing.

(*To be continued.*)

Editorial.

YELLOW FEVER.

In an editorial in the October number of the Journal, 1933, we gave an outline of some researches on yellow fever, which by means of a mouse-protection test showed that yellow fever might exist in certain unsuspected areas in Africa.

New facts concerning these so-called "silent areas" have been communicated to the Permanent Committee of the *Office International d'Hygiene Publique.*

Beeuwkes and Mahaffy have recently published a report on the distribution of yellow fever in West Africa. In Nigeria, the West Coast, Sierra Leone, Gambia, Liberia, Dahomey, and the French Niger they have had successful results with the mouse-protection test. They examined 7,580 specimens from 181 towns and 1,879 tests were positive.

In Nigeria the serum of infants and adults from 71 towns was examined; 67 gave positive results showing that these particular persons had been attacked by yellow fever, yet yellow fever had been notified in only 10 of these towns during the last ten years. The situation was considered to be due to cases not being diagnosed, as in West Africa, where the conditions are not so favourable to the persistence of infection, reports of cases of yellcw fever have been much more numerous.

The general conclusion of the inquiry was to the effect that yellow fever is more prevalent in West Africa than it was thought to be, and that practically all the eight colonies investigated are subject to the infection.

Lately, several regions in Anglo-Egyptian Soudan have been examined and positive results with the protection test have been obtained in Darfur, Mongalla and Bahr-el-Ghazal. In June, 1934, a native of Wau in the province of Bahr-el-Ghazal died after suffering from jaundice and albuminuria. At the autopsy all the tissues had a deep yellow colour and the liver showed advanced necrosis and the lesions of Councilman. Sections of the liver were sent to Dr. Findlay, at the Wellcome Bureau of Scientific Research in London, who confirmed the diagnosis of yellow fever.

At Port Gentil, Gambia, in French Equatorial Africa, yellow fever had never been diagnosed, but there were two suspicious deaths in 1927. In 1933, Dr. Burke found sera from infants 7 to 12 years old had no protective power: but out of sixteen sera from persons aged 19 to 45, three gave positive results with the mouse test. From these results it would appear that there had been no yellow fever for twelve years. In May and June, 1933, three persons were attacked with a febrile affection and two died. The serum from the third person, when she was examined some weeks later, protected a mouse against the virus of yellow fever.

In November, 1933, Dr. Soper of the Rockefeller Foundation read a paper before the National Academy of Medicine at Rio de Janeiro, Brazil, and described the difficulties he had experienced in diagnosing mild cases of yellow fever in the "silent areas" of Brazil. He found that the best method of detecting foci of yellow fever, which are the cause of the persistence of the disease in an endemic form in the north of Brazil, was to combine the mouse-protection test with the practice of removing at the post-mortem examination a portion of liver for examination. By this means cases of yellow fever which had no clinical symptoms of the disease had been found in these "silent areas."

It has now been decreed—"Service de Viscérotomie"—in Brazil that a portion of the liver shall be removed for microscopical examination from all cases dying from fever of a duration less than eight days. A special instrument, the viscerotome, has been devised for the removal of liver tissue. The Yellow Fever Commission has recommended the procedure, which is also prescribed in the Anglo-Egyptian Soudan and in French Equatorial Africa.

The spread of yellow fever to Asia is a subject of considerable interest, and the danger has become more threatening with the development of air traffic and the increase of mechanical transport in Africa. If yellow fever should reach the coast of East Africa its spread to Asia would be likely, as the sea route is short and trade is largely carried on by Arab dhows and coasting vessels, which are very difficult to control.

Discussing this subject, Dudley points out that the native Indian is not immune to yellow fever. He believes that Asia has remained free from yellow fever because of some biological obstruction to the free spread of the virus on its arrival there.

Hindle has shown that the Indian race of *Aëdes ægypti* can transmit yellow fever from monkey to monkey; but it did not seem to be quite so effective a vector as the African mosquito for the same virus. The African strain came from West Africa and was a typical dark-coloured race of *A. ægypti*. The Indian strain was obtained from eggs collected in the Punjab; it was lighter in colour than the West African mosquito, but apart from this it agreed with the description of the species.

Granting that the escape of Asia up to the present may have been due to the poor quality of the local potential vector, it by no means follows that local species of Aëdes will be unable to spread the disease in changed environmental conditions.

From this point of view, a localized outbreak of yellow fever which occurred in Brazil is of considerable interest. *A. ægypti* could not be found there; the mosquito *A. scapularis* was incriminated as the vector. The epidemic died out after a time, and Soper asserts that the disease did not die out from exhaustion of susceptibles, but owing to failure of the unusual vector. Yellow fever does not usually die out until 70 per cent of the

population have become immune, but in Brazil only 15 per cent were found to be immune subsequent to the epidemic.

Analogy with this Brazilian epidemic makes it possible that yellow fever may have been introduced into East Africa and Asia, but after causing an abortive epidemic the disease disappeared owing to some incapacity of the local vector. Hindle, however, considers that his results clearly indicate that if, by ill chance, yellow fever ever reached India, the local race of *A. ægypti* could serve as an efficient vector.

Sawyer writes that the recent observations on the epidemiology of yellow fever in South America show that among other measures vaccination against the disease must in the future play a more and more important role in its control.

For immunization against yellow fever the following methods have been employed: (1) Injection of convalescent human serum; (2) injection of a virus killed or attenuated by physical or chemical agents; (3) injection of a virus biologically modified; (4) injection of a mixture of virus and immune serum.

The idea of immunizing against yellow fever was first suggested by C. J. Findlay, and in 1903 Marchoux, Salimbeni and Simond immunized man by injection of serum taken from a case convalescent from yellow fever. But it was not until Stokes, Bauer and Hudson, in 1928, transmitted the disease to *Macacus rhesus* and proved that the causal agent was a filtrable virus that experiments on immunization were placed on a scientific basis.

Injection of immune serum has been little used as it produces only a temporary immunity. In 1931, Bauer showed that injection of large doses of immune serum in monkeys produced an immunity which lasted only fourteen days.

Immunization by means of a viscerotropic virus was attempted by Hindle in 1924; he prepared a vaccine by the action of phenol or formol on an emulsion of liver from an infected monkey. Vaccine prepared in this way was found to be very variable in its action; this was explained by Okell, who found that the antigenic power of a vaccine prepared from monkey tissues disappeared *pari passu* with the death of the virus. When the virus dies the antigenic power is lost. If a living virus is used there is the danger that yellow fever may result, and mosquitoes may become infected.

The injection of virus with immune serum was next suggested, and Pettit and Stephanopoulo showed that this procedure protected a monkey whether the virus was given before, with or after the serum.

Theiler and Sellards showed that the immunity might last two and a half months, and in 1931 Findlay and Hindle proved that monkeys vaccinated in this way were immune for fourteen months, or longer.

Serious attempts to vaccinate man by using yellow fever virus and immune serum were not made until the introduction of a virus modified biologically.

In 1930 Max Theiler discovered that the yellow fever virus, after

twenty passages through the brains of mice, became fixed for the nervous system, and injection of this virus into monkeys did not produce yellow fever. This discovery opened up new lines of immunization and, as in the case of the viscerotropic virus, experiments were made with the neurotropic virus combined with anti-serum, and with the virus alone after it had been attenuated.

In 1931, after preliminary experiments with monkeys, Sawyer, Kitchen and Lloyd immunized fifteen persons with a mixture of dried fixed neurotropic virus and human anti-yellow-fever serum. Later, in 1931, Sawyer injected forty other persons by the same method. In London, Findlay commenced immunization by injecting subcutaneously over the abdomen human anti-serum, and four to six hours later injecting under the skin of an arm a filtered suspension of 10 per cent of virulent mouse brain in normal human serum.

The objection to this method of immunization is the difficulty of providing sufficient human specific serum.

In 1934, Pettit and Stephanopoulo prepared a horse anti-yellow fever serum which had a much higher titre than human serum. They then injected this horse serum and living neurotropic virus into twelve persons; of these, only four had a rise of temperature above 38° C. Findlay immunized seventy-five persons with this serum in London.

Analysing the results of the vaccination of 305 persons in London by different methods, the International Committee found that about 5 per cent of persons had an abnormal susceptibility to the virus and might suffer more or less gravely from the inoculation. In order to avoid these reactions, it was considered that each person should receive an excess of antibody. The method recommended was to employ a high titre serum and to give doses of 0·3 to 0·4 cubic centimetre per kilo of body-weight. Findlay has employed 0·4 cubic centimetre of this serum per kilo of body-weight for the immunization of thirty-five persons without having a single reaction attributable to the virus.

It would simplify the method of immunization if an immunity could be obtained by the injection of a virus which, while maintaining its antigenic properties was so attenuated that it would not multiply in animal tissues or produce pathological lesions. Sellards and Laigret, in 1932, attempted to immunize by injecting small portions of mouse brain infected with neurotropic virus. One person, however, developed symptoms very suggestive of yellow fever.

In 1934, Laigret employed three injections of virus, each separated by an interval of twenty days. In the first injection, he used a mouse neurotropic virus attenuated by an exposure to a temperature of 20° C. for four days; for the second injection a virus which had been attenuated for two days, and for the third injection a virus attenuated for only one day. He has given 3,196 injections, but in only two cases were there severe reactions. There was a syndrome of meningitis in the first case and a syndrome of

myelitis in the second. Both patients recovered. Blood and cerebro-spinal fluid taken during the illness were *not* virulent for mice, nor for monkeys.

Laigret found that in the region Siere Saloum there was not a single case of yellow fever amongst Syrians who had been inoculated and lived in close proximity to the natives and were certainly exposed to the bites of *A. ægypti*.

Before employing Laigret's method of immunization Findlay experimented with monkeys to see if the inoculation of the virus was followed by its presence in the blood. He found that after the first injection of the virus attenuated for four days there was no neurotropic virus in the blood, but the monkey was not protected. If, however, the virus was not attenuated for so long a time, living virus could be shown to be present in the blood. Stephanopoulo and Mollaret obtained similar results.

Findlay also found that the virus could be inactivated by exposure to 1 : 50,000 of methylene blue, but the virus did not then immunize a monkey. He concluded that the attenuation of the virus by exposure for four days to 20° C. or by dilutions of methylene blue either killed the virus and there was no immunity produced, or the virus was not killed and circulated in the blood for a certain time.

If the virus circulates in the blood there is a danger that mosquitoes may become infected and also that the individual's resistance may break down and he may suffer from meningo-encephalitis; lesions in the liver, kidney and heart may also occur, the virus again becoming "viscerotropic."

Although Laigret and Durieux have found that immunization in French West Africa is not followed by any epidemics, Davis, Lloyd and Frobisher, and also Stephanopoulo have shown that the *A. ægypti* is capable of taking up the virus from the peripheral blood of an inoculated monkey and can then infect other animals.

Findlay concludes that as it has not been found possible to find a method which while attenuating the virus will prevent the appearance of virus in the peripheral blood, it will be more prudent to employ for the immunization of man a mixture of virus and immune serum, a method which reduces to a minimum the possibility of a living virus circulating in the blood.

Clinical and other Notes.

ATEBRIN AND MALARIA.

By Lieutenant-Colonel A. G. BIGGAM,
Royal Army Medical Corps.

During the last few years atebrin has been fairly extensively employed in the treatment of all varieties of malaria infection with, on the whole, very encouraging results. A recent report on the successful use of this drug in a series of cases of benign tertian malaria, with the usual five days' course giving 0·3 gramme daily, has been published by P. E. McNabb and S. C. Schwartz [1], and equally favourable results have been recorded by E. M. Tareev, A. Bolotina, A. Gontaeva, A. Raskin and E. Epstein [2]. S. P. James [3] has demonstrated the changes taking place in the parasite following a single dose of 0·6 gramme of atebrin showing the disappearance of the pigment and breaking up of the cytoplasm of benign tertian and quartan malaria parasites.

The drug has generally been used alone in daily doses of 0·3 gramme for a period of five days, but occasionally prolonged up to ten days without untoward results beyond the appearance of a yellowish skin discoloration which, after the more prolonged course, may persist for several weeks.

In resistant cases of malaria atebrin has been employed also in combination with or followed by plasmochin in the hope of obtaining better results. Theoretically, the combination would appear to be sound as the atebrin exerts its maximum effect on the asexual forms while plasmochin quickly eradicates the gametocytes.

A recent report by Chopra and Chaudhuri [4], however, indicates that the combination of atebrin and plasmochin simultaneously is not free from risk as the atebrin appears to increase the toxicity of the plasmochin. They report in detail a number of cases of poisoning with various combinations of these drugs. Chalam [5] also describes untoward results in a large percentage of cases where atebrin and plasmochin were used in combination and he considers it safer to use the drugs separately, giving atebrin for the first five days followed by plasmochin for the next five days.

This tendency to combine the use of atebrin and plasmochin in the treatment of malaria suggests that the former drug alone has not always produced satisfactory results. I have had recently under my care a small group of consecutive cases of relapsing benign tertian malaria in which the results of the exhibition of atebrin alone appear to support the above view. This group of four cases was treated with atebrin 0·3 gramme daily for five days, none of these having had this drug before, followed by a course of iron in large doses to combat the anæmia, with the following results:—

(1) Signalman A. had benign tertian malaria in Peshawar. Treated

in hospital from November 1 to 17, 1931, with the usual course of plasmochin and quinine. He returned home in 1934 and was admitted under my care on June 25, 1934, suffering from benign tertian malaria; parasites present, spleen not palpable. He was given 0·3 gramme atebrin daily for five days, followed by oral iron for his anæmia, and was discharged on July 9 afebrile, and no parasites were seen in smear. Readmitted August 13 with relapse; benign tertian parasites present; febrile.

(2) Lance-Corporal L.: Malaria in India with three admissions to hospital for this disease, treated with plasmochin and quinine. He came home towards the end of 1933 and was admitted to hospital January 3, 1934, benign tertian rings and gametocytes being demonstrated. He was given the same treatment as Case 1 and discharged hospital on January 10 afebrile, and free from parasites. Readmitted April 30 with fever; parasites again present in large numbers.

(3) Signalman F.: Malaria in Quetta, treated in hospital October 14 to November 9, 1933: benign tertian infection. Admitted Aldershot June 13, 1934, with fever; benign tertian parasites present, treated as above. Readmitted July 16 with fever, parasites again present.

(4) Lance-Corporal C.: Served in Hong Kong. Stated he had no malaria there. Home April, 1934. Admitted to hospital Aldershot July 27, 1934, with fever, benign tertian parasites present. Atebrin treatment as above. Discharged free from parasites, and afebrile. Readmitted October 30, 1934, with fever which he stated had recurred within five weeks of leaving hospital. Spleen enlarged; benign tertian parasites, schizonts and gametocytes, present.

The poor result obtained in the above four cases of benign tertian malaria contrast with the response to the same atebrin course obtained in the treatment of malignant tertian malaria in an officer recently returned from a blackwater fever district of Africa. He had developed an irregular fever on board ship on his way home, but no parasites were found and he was considered to be a case of pneumonia. He proceeded to his home where treatment for pneumonia was continued until the presence of an empyema at the left base was suspected, when he was admitted into hospital for treatment. On admission he was found to be very markedly anæmic; spleen easily palpable and tender; very numerous malignant tertian parasites were seen in a thin smear.

It was considered safer to avoid quinine, lest blackwater fever should be precipitated, and the usual short course of atebrin was given followed by iron to combat the anæmia. His recovery was uninterrupted; he was seen four months later and had up to that time had no further symptoms and felt extremely well.

Summary.

(1) A small consecutive series of chronic benign tertian malaria is recorded in which the usual course of atebrin, 0·3 gramme daily for five days, failed in each case to bring about a cure.

(2) Reports are quoted indicating that the simultaneous administration of atebrin and plasmochin, which theoretically would appear to be therapeutically sound, is not free from risk, the atebrin apparently increasing the toxicity of the plasmochin.

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DISPOSAL OF WASTE WATER.

By Major S. M. HATTERSLEY, M.C.,
Royal Army Medical Corps.

Under field conditions various methods have been recommended for the disposal of waste water from kitchens, ablution places, bath houses and laundries, but their success is much affected by local conditions and the quantity of water to be disposed of.

Unless a perfectly clear effluent, free from soap and grease, is obtained, the sides and bottom of a soakage pit will rapidly become impermeable and a nuisance result. Again, in a clay soil or other places where a soakage pit cannot be used, the effluent has to be discharged into a stream or ditch. In such circumstances it is still more important to produce a clear effluent.

A trap can only be expected to keep back the grosser particles in suspension and a certain amount of grease. Treatment by chemical precipitants is therefore the only solution possible.

Bleaching powder and lime have been recommended in the past [1] and experiments were carried out using these two chemicals. Such a large quantity had to be used, however, and the results were so poor that it was decided that other methods and precipitants must be tried if a perfectly clear effluent was to be obtained.

As the question of the pH value [2] does not appear to have been considered in connexion with the disposal of waste water in the field, tests were made with various precipitants and the pH value of the waste water adjusted, after the addition of the precipitant.

Alumino-ferric, ferric sulphate, and ferrous sulphate all gave good results, provided the pH value was adjusted by the addition of sodium hydroxide. After many experiments, it was decided that ferrous sulphate was the most suitable chemical to use. It produced a very heavy floc, which settled down in a few minutes, leaving the supernatant water perfectly clear. It also had the advantage of being cheap and an article of supply.

The use of sodium hydroxide to adjust the pH value was a disadvantage, but it was found that equally good results were obtained by using lime to adjust the reaction. Lime has the further advantage of being cheap and always readily obtainable.

It was realized that the determination of the pH value was not a practical proposition in the field, but by using phenolphthalein as an indicator, the correct reaction could be obtained. The waste water was first dosed with ferrous sulphate. Lime was then added until a sample of the water, in a test tube or cup, gave a definite pink colour with phenolphthalein.

After the first few experiments, it was found that there was no need to use the phenolphthalein. When the correct pH value had been obtained, the result was so striking, due to the formation of a heavy dark-green precipitate and the clearing of the water, that no indicator was necessary.

This method of treating waste water was then tried out on the soapy water from an ablution shed and the greasy water from a cookhouse. As the results were satisfactory, a thousand-gallon pit was constructed at the Army School of Hygiene, to take all the waste water from the cookhouse, ablution shed and regimental institute. Two outlets were provided. One was a short distance from the bottom, to run off the clear effluent and the other at the bottom, to run off the sludge.

Experiments are still being carried out with this pit. Up to the present, the effluent has always been perfectly clear and the sludge gives no trouble as it does not smell or decompose.

General Description of Method.

The success of the method depends on adjusting the pH value of the waste water with lime after it has been dosed with ferrous sulphate.

The waste water is collected in a tank. A pipe is fixed a short distance from the bottom so that the clear effluent can be drawn off, after sedimentation has taken place.

The quantity of ferrous sulphate required will vary with the nature of the waste water to be treated. Ten grains per gallon may be sufficient for a simple soapy water, but fifty grains may have to be used for a very foul sullage water.

A sample of the waste water should be taken in an old biscuit tin, cresol drum or other receptacle of known capacity. Ferrous sulphate is added to the sample (say twenty grains to the gallon) and well mixed. Lime is then added until the reaction is alkaline to phenolphthalein. A heavy dark green precipitate forms and settles down at once. If the supernatant water is not absolutely clear, more ferrous sulphate should be added and the reaction again adjusted by the addition of lime.

From the amounts of ferrous sulphate and lime used for the sample, the quantities required for the whole bulk of waste water can be calculated.

The ferrous sulphate should be dissolved before adding it to the waste

water. It is very soluble, but time is saved by breaking up any lumps present. It must be added first and well mixed.

Similarly the lime must be mixed with water before being added. After the addition of each chemical, thorough stirring of the waste water is an important point.

Sedimentation takes place in a matter of minutes, but the longer it is left, the closer the floc packs down.

The use of the phenolphthalein is helpful when the method is being tried out for the first time, but after this there is no need to use it. The formation of the dark-green floc and its rapid sedimentation are sufficient guide.

When waste water is being treated daily, the taking of a sample to determine the correct dose of ferrous sulphate is not really necessary. The waste water from the cookhouse and ablution shed at the Army School of Hygiene has been found to require between twenty to thirty grains per gallon. Three and a half pounds of the ferrous sulphate to the thousand gallons are therefore added as a matter of routine. The milk of lime is then poured in until the dark-green floc is formed.

Ferrous sulphate is known commercially as "copperas," "green vitriol," "green copperas," or "sulphate of iron."

I am indebted to Colonel H. H. A. Emerson, D.S.O., Commandant, Army School of Hygiene, for permission to forward for publication this preliminary note on the method.

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Travel.

FROM SINGAPORE TO NORTH CHINA AND JAPAN.

By Major J. R. HAYMAN,
Royal Army Medical Corps.

(*Continued from page* 137.)

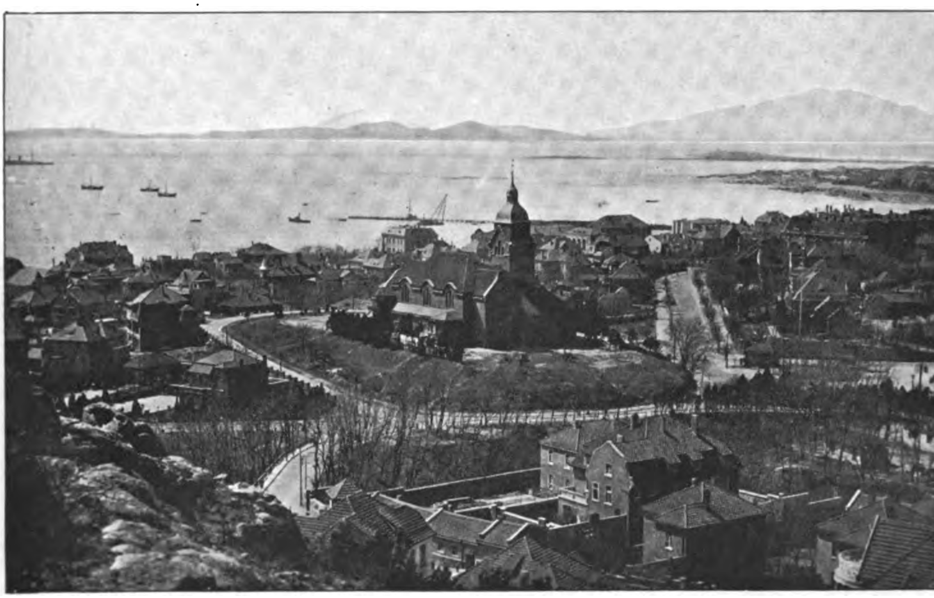
Shortly after leaving Peking we passed a dilapidated-looking freight train, which, judging from its appearance, must have seen some serious war service. Further on, we passed two armoured-car trains. The armed guards were resting, or sleeping blissfully on the carriages.

We arrived at Tientsin just after the train to Peking had left the station and it was then two and a half hours late.

The following day (May 15) we were told that the railway service south of Tientsin had been commandeered by the retreating Chinese army, which was being driven back by the Japanese forces in that area.

The shipping agents then very kindly arranged that we should be taken back to the S.S. "Patroclus" by a tug which was to leave Tientsin at 8 a.m. on the morning of May 16. From the point of view of a traveller, and one who was anxious to see as much as possible of the country, this was all to the good.

The last evening was spent at a very enjoyable little dinner party. Later a visit was made to one of the local Russian cabarets. What a difference it makes if one is in pleasant company at these shows. Closing time, 4 a.m., arrived all too soon. At 8 a.m. we boarded the tug and proceeded downstream to Taku. The Peiho River varies in width from 50 to 150 yards. It is a tidal sluggish stream, passing through flat uninteresting



Overlooking the Bay at Tsingtau.

country. The banks are generally bare, and devoid of vegetation. Here and there are small Chinese mud-hut villages, and in the immediate vicinity there is a certain amount of cultivation to be seen. There is the usual scarcity of trees in this area. At 12.30 p.m. we reached the mouth of the river, and here we were again examined by the customs official. Oddly enough, there is an *export* tax on local-made goods from China. At 3 p.m. we left Taku and reached the S.S. "Patroclus" at 4.45 p.m. And thus ended our little excursion to Peking.

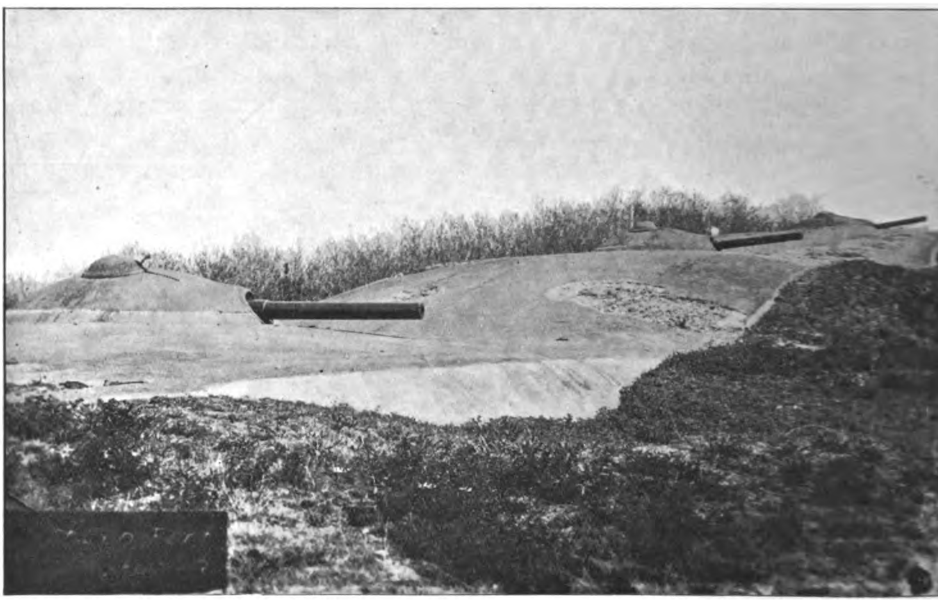
Judging from such guide books as "Pekin," by Juliet Bredon, and a "Guide to Peking," published by *The Leader*, 1931, we missed a large number of places of interest that were well worth seeing.

But sight-seeing, if hurried, can be monotonous and wearisome.

A tourist might well spend a week at Peking and carry out his programme in a more leisurely and enjoyable manner.

Incidentally the new name of the city—"Peiping"—is merely an adaptation of one of the names by which the city was known previous to A.D. 1400. The city was described by the Venetian traveller, Marco Polo, in the thirteenth century. Actually, commerce had existed between China and the Eastern European communities for centuries previous to this date.

Our next port of call was Tsingtau, a seaport town lying about mid-way between Taku and Shanghai, and here we were expected to stay two days. "Why?" we asked, and we were told that it was on account of eggs!



Part of the German Defence Scheme, Tsingtau.

The ship was expected to load over 2,000 tons of cold storage eggs in specially refrigerated bunkers. So we pictured Tsingtau as a miserable port surrounded by barnyards of crowing cockerels and broody hens.

We arrived in the bay of Tsingtau on the morning of May 18. There was some delay in reaching the wharfs as the ship had to make a circuitous route round some islands, and this necessitated the services of a pilot. The weather was very wet and stormy, and remained so until the evening.

A party of us then got off the boat, and hired a taxicab to take us round the town.

Leaving the dockyard area, we went to the business and residential centres.

And here we were surprised to find wide well-paved streets, and fine

substantially built houses and hotels. Farther on, we reached the bathing resort which has a long stretch of sandy beach. Behind the beach is a well-laid-out park and a racecourse.. Tsingtau bears some resemblance to Bournemouth on a larger scale, as it is built on the slopes of a hill overlooking a fine bay. Passing round the farther extremity of the bay, we came to a promontory on which had been sited one of the old German forts. The battery consisted of three 6-inch and two 12-inch guns embedded in a massive concrete foundation. The fort was in charge of a Chinese caretaker, and was in a good state of preservation except that one of the 12-inch guns had become displaced.

We then walked back, passing through streets and avenues flanked on either side by most attractive-looking suburban villas.

We motored through the Park and returned to the ship by another route. After dinner, a friend and myself visited some of the local Russian cabarets. Well, they were at least amusing! The next day, we explored other parts of the town, and then motored up the wooded hillside overlooking the bay and the town below. Behind the hills, again, is a massive range of mountains which can be reached by a good motor road.

The history of Tsingtau is worth recording. In 1897, two German missionaries were murdered by Chinese in the neighbouring province. As a recompense, the German Government acquired the Tsingtau Concession—an area of land extending some thirty miles along the coast. At that time, the Concession area was more or less a stretch of barren hills like that of the surrounding country, and the only residents were in a few small Chinese fishing villages.

The German Government lost little time in making a plan to develop the place. With true Teutonic thoroughness, they formed an ambitious scheme to make Tsingtau a commercial rival to Shanghai—a naval base, and a large residential resort. A railway line was constructed to cut into the traffic of the Shanghai-Peking route, and to tap the resources of the neighbouring provinces. Millions of capital were poured into the place, and a large German colony sprang up. In 1914, at the outbreak of the Great War, the local German naval squadron dispersed, and the famous cruiser "Emden" set out on her path of destruction. A small German land force was left to protect the town.

The Japanese then declared war, and sent a large force assisted by a small British contingent to take the town. In the ensuing siege which lasted two months the Japanese lost 1,000 men and the British 13. I was unable to locate the British cemetery, but understand that it is well cared for. Tsingtau remained under Japanese control until 1922, when it was handed over to the Chinese Government. Some three or four Chinese cruisers were in the harbour while we were there, and according to the Press this little fleet mutinied a couple of months later.

A few Germans still remain in Tsingtau to keep the flag flying, and do some business. Apart from them the Chinese form the bulk of the inhabitants, the remainder being mostly Japanese and Russians.

While the passengers spent their time amusing themselves in the town, the ship was busy day and night loading boxes of eggs. Lorry-load after lorry-load was taken direct from the cold storage to the refrigerated bunkers. We were told that the firm sent out collecting agents to the Chinese villages in the hinterland. Here they bargain in hard cash, carrying with them sacks of copper coins. The eggs have to be most carefully tested and sorted out in the factory, as one bad egg might ruin the contents of a box holding more than 700. They are then freighted for disposal in Great Britain and the continent.

We left Tsingtau on the morning of May 20, and steamed direct to Yokohama which we reached on the afternoon of May 23. The entrance to the harbour reminded one of the coast of Devon, with its undulating wooded cliffs. The passport business was a little tedious.

With this business over, we were free to go ashore, and as far as we knew, we were not subject to any surveillance. Of course, there are restricted areas which in any case would scarcely attract the tourist.

We were only staying at Yokohama three days, and it was advisable to see as much as possible within that time. So, having obtained some local currency from one of the banks, I found my way to one of the railway stations and set out for Kamakura, which lies some fifteen to twenty miles to the west of Yokohama. In the eleventh century it became the capital of the Shogun territory as opposed to the territory of the Mikado which lay to the west of Japan. Kamakura has now dwindled down to what is little more than a country village. On arriving at the small station, I engaged a rickshaw to take me to the famous Daibutsu, a gigantic statue of Buddha, which is about one and a half miles away. The statue is certainly an imposing sight standing as it does some thirty-six feet above the pedestal. The rickshaw boy then took me to the local bathing resort, but that was not in the least attractive. In the district of Kamakura are many famous shrines and temples, but I did not see them. Instead, I took a local bus and went on another four miles to the village of Katasé, which lies opposite to the sacred island of Enoshima. From the bus halt, there is a picturesque alleyway leading to the shore. It is flanked on either side by numerous shops, selling curios, ornamented sea-shells, and similar things. A rickety wooden bridge, some four hundred yards long, connects the island to the shore. Enoshima is a relatively small, wooded island scarcely more than a mile in circumference and rising about 300 feet above sea level. On the other hand, it is extremely picturesque, with its grottos, shrines, temples and shaded walks. A local guide offers his services and it saves time to accept them. Looking towards the west one sees the dim outline of a mountain which resembles the contour of the famous Mount Fuji.

Leaving Enoshima, I returned to Katasé, and came across a light rail tramway. Inquiries led me to believe that it ran in the direction of Yokohama, so I took a ticket and hoped for the best. The tram ran well for nearly three-quarters of an hour and then stopped as it had reached its

terminus, and that was many miles from Yokohama. Further inquiries brought me to another station, and from there I was able to take a train direct to Yokohama. A taxicab then brought me back to the shipping wharf. The incident is related rather to show that a complete stranger with no knowledge of the Japanese language can find his way about the country with comparative ease. This can be only attributed to the courtesy and patience of the Japanese themselves, many of whom have a passing knowledge of English and appear only too willing to help the tourist in distress. In addition, there are many Government tourist bureaux in the different towns, and the officials are always ready to give any information regarding travelling facilities. After dinner, I hired a rickshaw to take me to Bentendori, the principal shopping street of Yokohama, with the idea of seeing a local cinema, but found that these places closed at 10.15 p.m. The well-lighted street, on the other hand, was alive with people, not unlike Hammersmith Broadway on a Saturday night, except that the Japanese shops seem to be kept open till midnight or maybe later. One particular shop appeared to have nothing else for sale than an extensive variety of snakes, dead and alive, poisonous and non-poisonous. A curious method of advertising was to employ poster girls and boys dressed in weird kit, who individually danced their way along the street to the tune of a flute and tinkling bells, rather like sketches of the Pied Piper of Hamelin.

A long stroll up and down this street gave me a thirst, so I stopped at a brilliantly lit café restaurant. I was received at the entrance by four or five Japanese maidens who all bowed deeply and gravely together, and inquired my wants. It took my breath away, and I could only murmur "beer." This arrived in due course and the waitress was kind enough to sit down with me and share it. She chatted away in a friendly manner, but the language was Greek to me. Her place was then taken by another waitress who went through the same performance. One felt that one was missing a good deal through not being able to carry on the conversation.

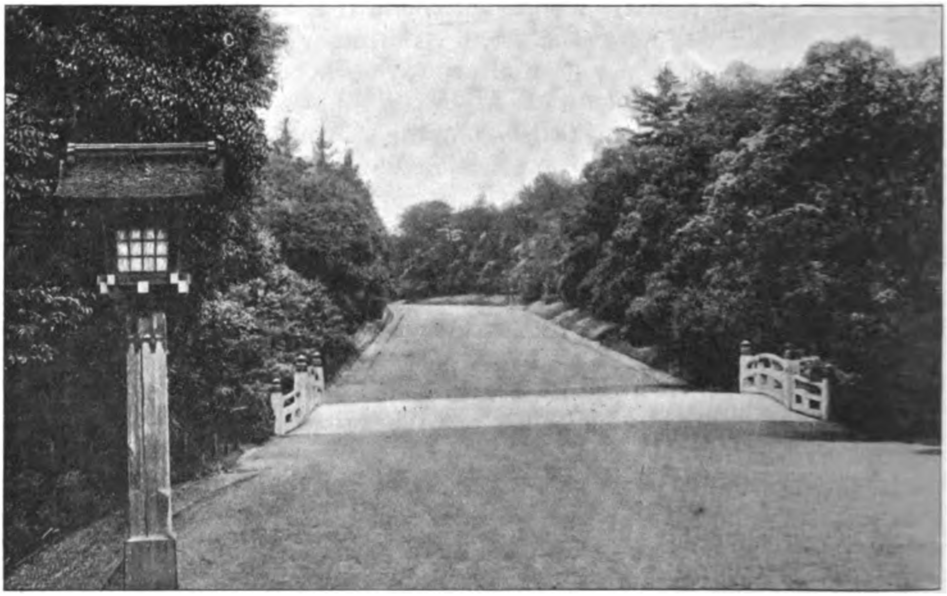
The next morning I went by train to Tokyo to spend the day there. The journey takes forty minutes by the electric railway, and we passed through a succession of suburban villages and over flat country heavily cultivated. In places, the countryside is littered with overhead electric wires, so that, at times, we felt as if we were passing under a giant cobweb.

On arriving at Tokyo station, I wondered which direction to take, so decided to follow the crowd. A Japanese gentleman then came up to me and asked if I was a stranger to the town. He said that he was a business man and would gladly assist in showing me places of interest for the privilege of improving his knowledge of English. Tokyo is a city with a population of two and a half million, covering an area of twenty-nine square miles, and consequently a tourist is apt to get lost without some assistance.

A short distance from the station is the Imperial Palace. It occupies an extensive area and is surrounded by a wide moat and a protective

rampart-like wall. The public are not admitted within the walls. We next went to the British Embassy and signed the visitors' book. A member of the staff inquired if I wanted anything.

Leaving the Embassy, we then went to a Park which contained the Meiji Shrine. The avenues and pathways were cleverly laid out. The Meiji period or "enlightened era" commenced in 1868. Previous to this, Japan had been governed under the feudal system, with the Mikado controlling the Western area, and the Shogun the Eastern portion. European nationalities and the United States were then competing for trading facilities, and threatening to use force when diplomacy failed. In the circumstances, it was necessary for Japan to unite under a single government for purposes



Meiji Shrine Park.

of self-preservation. Following some desultory fighting, the Mikado's party obtained complete power. From that date, the Japanese have devoted themselves with an intensity of purpose to becoming a Power that would rival any possible foreign aggressor. Their rate of progress towards this end in the relatively short period of seventy years has been phenomenal.

The Meiji shrine is a group of edifices built of teak or some similar type of wood. Their effect is imposing on account of the simplicity of design and wonderful craftmanship. Approaching the shrine, we passed by a drinking fountain. My Japanese friend said it was the custom for a visitor to wash his mouth out with some of the fresh water, then drink a little water, and finally wash his hands before proceeding further. So we

complied with the custom and proceeded to the entrance of the main shrine dedicated to the Meiji Emperor. Here the Japanese visitor claps his hands twice, and then utters a short invocation.

(*To be continued.*)

Echoes of the Past.

THE CASE OF CORPORAL BIGGS: A CASE OF HEPATITIS CHRONICA.

From the Half-yearly Medical Report, 1820, in the Office of the Deputy Director of Medical Services, Malta.

In Corporal B., whose case ended in death, there was an hydropic diathesis, the effect of universal debility, brought on by a long course of intemperance in the use of intoxicating liquors; he was a drunkard in the most unlimited acceptation of the word. This unfortunate man had received a good education and had moved in a higher sphere of life, but either from misfortune or misconduct, or both, had been reduced to the miserable alternative of enlisting as a private soldier. Perhaps with a mistaken view of obliterating the remembrance of his better fortunes, of soothing the mortifications of pride, or of rendering impotent the insolence of superiority, he had originally been induced to drink deeply of the deleterious draught which at the early age of 32, deceitfully conducted him to a premature dissolution.

On his admission, the symptoms were of a very unfavourable nature, such indeed as to leave little hope of any benefit to be derived from the interference of art, especially on adverting to the predisposing and proximate cause of his complaint.

He was treated chiefly with purgatives, diaphoretics, and warm baths. The blue pill in combination with squills in the proportion of 5·3 grains, taken morning and night, was the medicine principally relied upon for any advantage to be gained. This is an active and powerful medicine, and, in most cases of a similar nature, will make an impression, but in this it proved altogether inefficacious.

On asking him from time to time how he was, he always replied that he was better, and that he was free from any pain whatever.

He appeared to flatter himself with sanguine but alas! vain hopes of recovering, which had a tendency at least to calm and even exhilarate him.

On the morning of the 17th, the day on which he died, he became low and desponding, a presentiment of his approaching change.

He was admitted on the 8th, and died on November 17th.

Current Literature.

ZRUNEK, C. Les vaccinations dans les armées au point de vue de la législation. **[The Legal Aspect of Vaccinations.]** *Arch. Méd. Belges.* 1934, v. 87, 599-606.

This article is of interest, not so much from the legal aspect, in spite of the title, as from the public health aspect of vaccination of soldiers. As regards vaccination against smallpox, the author divides armies into three groups: (1) Countries which enforce revaccination by law for all subjects of 20 or 21 years of age (therefore, those in the army also), France, Russia and Uruguay; (2) the same as the last as regards the general population but with certain stipulations (not detailed) as regards the army; these are Norway, Sweden, Rumania, Turkey and Brazil; (3) most others; where vaccination is provided for by special army orders or Army Council Instructions.

Vaccination against other infective diseases varies greatly and depends almost entirely on *ad hoc* regulations. France makes antityphoid and anti-diphtheria inoculation compulsory for soldiers, and, following this example, Czechoslovakia brought forward a law to make all kinds of vaccination compulsory for the army on the recommendation of the Minister of National Defence; this law was passed in July, 1934. H. H. S.

Reprinted from "Bulletin of Hygiene," Vol. 10, *No.* 4.

WENZEL. Tränkstoffe und Schutzanstriche zur Holzkonservierung und ihre gesundheitlichen Gefahren. **[The Health Risks in the Impregnation and Painting of Timber for Preservation Purposes.]** *Zent. f. Gewerbehyg. u. Unfallverhütung.* 1934, v. 21, 129-47, 1 fig.

Timber is impregnated or painted with various chemical substances to protect it against rotting. The chief of these substances are mercuric chloride, zinc chloride, copper sulphate and tar derivatives as cresol, nitrophenol, dinitrophenol and dinitrocresol. The toxic properties of all these are well known as also the precautions necessary in dissolving them and working with the solutions.

Mercuric chloride, which is readily soluble in water, is used in a strength of from 1 : 200 to 1 : 100. As iron tanks cannot be used for this solution it is necessary to use receptacles made of wood or cement. The timber has to lie in the tanks from 192 to 240 hours. Zinc chloride is used in the strength of 1 part in 40 of water for treating railway sleepers in America, France and Russia. It has the advantage of cheapness and ready solubility. Copper sulphate is also cheap and is used in the strength of 1 : 150 water, but cannot be used in iron tanks.

It is very important that all timber after soaking should be thoroughly

dried before handling as if the timber is moist the preservative material can act injuriously on the skin. A period of three months is considered necessary for drying. Even when the timber appears dry it may injure the skin. Men who carry on their shoulders railway sleepers impregnated with creosote often get eczema on the neck, shoulders, arms and hands, particularly if there is strong sunlight, so that it is recommended that such work should during the summer be done only in the early mornings or evenings, or that a canvas awning be erected when sleepers are loaded into trucks. In any case the men should wear a stout piece of leather protecting the shoulder, the side of the neck including the ear, and the hands should be rubbed with fine chalk or clay. After heavy rain creosoted sleepers should not be handled till dry as certain ingredients of the creosote become dissolved in the moisture and act as skin irritants. Wounds from splinters of wood treated with mercuric chloride or creosote are seldom serious owing to the disinfecting power of the preservative.

With the exception of eczema caused by the tar derivatives no injury to health is to be expected in treating timber with preservatives if modern precautions are taken. A. J. COLLIS.

Reprinted from "Bulletin of Hygiene," Vol. 10, *No.* 4.

GYLLENSWÄRD, C. **Smallpox Vaccination in Childhood, in the Light of Results of Inoculations in the Swedish Army, 1908-33.** *Svenska Läkaresällskapets Handlingar.* 1934, v. 60, 269-317, 3 charts.

Since 1816, vaccination has been compulsory in Sweden before the end of the second year of life. Revaccinations have usually been timed for the military age, 21 to 22. The fact that during the last decade nearly 90 per cent of the revaccinations in the Swedish army have "taken" has commonly been construed to mean that the immunity conferred by vaccination in early childhood had totally disappeared. Gyllenswärd does not accept this construction. Observations during fifteen years on several thousand military revaccinations, compared with primary vaccinations at various ages in childhood, have convinced him that the army reactions are very varied and must be regarded in the great majority of cases as immunity reactions whose behaviour is influenced by the primary vaccination in childhood. In the past, a single inspection of army revaccinations has sufficed. In 1932, on the recommendation of Professor Lichtenstein and Professor Kling, three inspections were ordered (after twenty-four hours, on the fourth day, and after one week) in order that distinctions might be made between fully developed vaccine pustules and allergic reactions. The reactions observed after twenty-four hours were recorded as early immunity reactions, those positive on the fourth day and then passing off, as late immunity reactions, while those reaching their maximum only after a week or later were recorded as typical vaccine pustules. The number of scarifications was fixed at one. The assignment of the reactions to one or other of these categories was left to the personal judgment of the medical officers whose

estimates have proved to vary somewhat. After the omission of certain unsatisfactory reports, the table below was compiled.

TABLE XII.—INOCULATIONS IN 1932.

Number inoculated	Results								Number sick-listed	Number sick-listed of 100 inoculated	Number of sick days	Sick days for each sick-listed
	Immunity reactions				Typical vaccine pustule		No reaction					
	Early in all	%	Late in all	%	In all	%	In all	%				
26,071	8,243	31·6	7,096	27·2	6,259	24·0	4,473	17·2	523	2·0	2,206	4·2

NOTE.—Inoculation with one scar in all cases.

Gyllenswärd concludes that the primary vaccination in childhood confers an immunity which, even after twenty years, renders revaccination a comparatively trifling matter. Primary vaccination in early adult life entails much more illness and the risks of encephalitis. "The inconveniences caused by child vaccination and the necessary later revaccinations, plus those occasioned by other protective measures against smallpox infection, are so wholly subordinate to those that would otherwise be caused by primary vaccinations and other measures affecting the economically most important ages, that in any case child vaccination becomes socially justified. In order to obtain sufficient protection, however, at least *one* revaccination must be made." From a purely medical point of view, revaccination at the age of about 20 would be best, but for practical reasons it may be preferable to time revaccination for the latest age at which the population is still kept together in the schools. At all events, "from the point of view of military hygiene, child vaccination is of fundamental importance."

C. LILLINGSTON.

Reprinted from "Bulletin of Hygiene," Vol. 10, *No.* 4.

FRICKER, J. La réaction de Schick. Ses rapports avec l'endémie diphtérique en France. [**The Schick Test and its Relation to the Incidence of Diphtheria in France.**] *Arch. Méd. et Pharm. Milit.* 1935, v. 102, 47-119, 1 fig.

In the first sixteen pages of this report the author discusses the technique of the Schick test, the interpretation of its results and the degree of error attaching to the classification of reactors and non-reactors. In the following sections the statistics are set out and discussed of Schick reactions amongst young soldiers of 20 years of age conscripted from all social classes and areas. The total 7,833 tests gave 51·3 per cent positives. It is believed that the cavalry suffer more than the infantry from diphtheria, but the

percentages of positive reactors are identical. Amongst 212 non-commissioned officers with a mean age of 28 years the percentage of positives was only 40·5 and in 76 officers with a mean age of 37 years it fell to 18·4. Taking the figures for each year of age a rapid and steady fall in the percentage is apparent from 20 to 42 years. Of 112 soldiers who declared they had had diphtheria in childhood 47·3 per cent gave a positive reaction.

A seasonal comparison shows no appreciable difference between 1,986 tests made in May and the remainder (5,847) made between November and February. A rise in the percentage of positives is observed between 1930 and 1933. Classifying the men according to the region of the country from which they had been recruited gave percentages of positives varying from 29 to 63. These percentages for different areas are compared with the recorded morbidity and mortality statistics in 1928 for the same areas and a certain degree of parallelism found (the method of comparison is somewhat crude, consisting merely of ranking the 62 districts in order for the different characteristics). As causes of the variability in the incidence of diphtheria the author discusses density of population, location, altitude, atmospheric factors and occupations. A. BRADFORD HILL.

Reprinted from "Bulletin of Hygiene," Vol. 10, *No.* 4.

LANCET. 1935, Jan. 19 & 26, 170-73; 228-30, 6 charts. **The Problem of Diphtheria.**

In the autumn of 1933 the number of notifications of diphtheria was for each week between 10 and 20 per cent above the average (as measured by the median value) of the corresponding weeks of the preceding nine years. During 1934 notifications remained at a high level, the summer decline of incidence was less than usual, and there was a rapid rise in August so that in the last two weeks of the year the number of notifications exceeded expectations by 60 per cent. The notification rate of 1934 (1·7 per 1,000 persons) nearly reached those recorded in the two years of high prevalence, 1920 and 1930. From 1911 to 1933 the notification rate has shown no pronounced tendency to fall while the death and fatality rates have declined considerably. It is difficult to say how much of this fall in fatality is due to more accurate diagnosis and better notification. If these were the only factors an increase in fatality could hardly be expected, since any falling off in the standards of diagnosis and notification would be now unlikely to occur. A slight upward tendency in the fatality rate since 1930 may therefore be genuine evidence of an increase of virulence. The fatality rates (deaths per 1,000 cases) in the 118 great towns were 47·1 in 1932, 51·7 in 1933, and 52·6 in 1934. Recalling Newsholme's theory of a relationship between diphtheria epidemics and deficient rainfall it is possible that the recent spell of dry weather may have in some indirect way favoured the dissemination of the more invasive strains of bacilli.

Artificial active immunization of school children may increase the density of virulent carriers—such an increase has been shown in at least

one institution. Such an effect will, of necessity, increase the risk of infection to those who remain Schick-susceptible, and therefore every effort should be made to inoculate children of pre-school age and all susceptible children of the same household. The Schick test should be used after each course of inoculation in order to find out if immunity has resulted, and, if it has not, inoculations should be continued until the reaction becomes negative. Otherwise repeated reports of severe cases among children who have been inoculated but never immunized may cause antidiphtheria inoculation to fall into disrepute. The author concludes that active immunization, systematically carried out, particularly amongst young children from one year old upwards, is capable of reducing the incidence of diphtheria, but that no real progress will be made without the whole-hearted support of the general practitioners, who are the real advisers of the public in health matters. Hence he discusses some of the points about which they may be consulted—safety, reactions, duration of immunity, and negative phase. He concludes with a section on the advantages of serum treatment. [The statistics purporting to show that "lives are saved in proportion to the promptitude with which antitoxin is administered" are, it must be noted, incapable of proving that thesis—however well founded the observation may be on other grounds. Cases admitted to hospital several days after the development of illness must include a larger proportion of severe infections than those admitted in the early stages. Patients who are recovering will, naturally, not be admitted to hospital, or be treated with antitoxin, five or six days after the development of the disease; those who are seriously ill at that point of time will be transferred and have a relatively high fatality rate.] A. Bradford Hill.

Reprinted from "Bulletin of Hygiene," Vol. 10, *No.* 4.

Hobson, F. G. **The use of Convalescent Measles Serum in School Epidemics.** *Lancet.* 1934, Dec. 22, 1408-11, 2 figs.

This discursive paper contains several very sound observations on the occurrence and prevention of measles in boys' boarding schools, but the main points of interest are that the author believes that infectivity in measles should be considered as commencing at least six days before the rash and may be accompanied by no diagnostic feature except a rise of temperature, that the generally stated incubation period of fourteen days is too short, particularly if serum is injected, and the quarantine period should certainly be twenty-one days. Interesting details are also given of an attempt to secure mass attenuation among 51 susceptibles by means of serum. This was given on the sixth day in uniform doses of 6 cubic centimetres, a few very small boys receiving 5 cubic centimetres, and a few very big boys 8 cubic centimetres. Of the total two refused serum and both escaped, 39 were completely protected, 6 had modified attacks, and 4 uncomplicated attacks. A plea is made for greater precision and uniformity in the serum therapy (? prophylaxis) of measles. A. Joe.

Reprinted from "Bulletin of Hygiene," Vol. 10, *No.* 4.

Reviews.

THE VITAMIN B REQUIREMENT OF MAN. By George R. Cowgill, Ph.D., Associate Professor of Physiological Chemistry in Yale University. Published for the Institute of Human Relations by Yale University Press, New Haven. London: Humphrey Milford, Oxford University Press. 1934. Pp. xx+261. Price 18s.

This most interesting book describes the attempt—successful as we think—by the author to assess the amount of vitamin B 1 which the average healthy human being must ingest each day to remain in perfect health, all other necessary dietetic constituents being present in the daily menu in their correct amounts and proportions.

Although a vast amount of research into the properties and functions of the vitamins has been carried out in the past fifteen years, practically nothing has hitherto been ascertained about their quantitative effect on man.

As Professor Cowgill points out, one of the chief bars to progress is the fact that "the condition which must be studied in making the measurements usually involves the production of a disease, a fact which almost entirely precludes any organized and planned experimentation on human beings." Our knowledge must therefore be derived from experiments on laboratory animals. The greatest caution, however, is necessary in applying to man the conclusions drawn from such experiments, since the quantitative requirements of laboratory animals themselves differ widely for each species.

Professor Cowgill conceived the idea "that if some common relationship should be found to hold for quantitative data derived from several animal species, there would be some justification for believing that this same relationship holds for the human species." He, therefore, by the most carefully controlled experiments, determined the minimum daily intake of vitamin B 1 necessary to keep the mouse, rat, dog, and pigeon in health, and from the data thus obtained he has shown that for these four animals the vitamin B 1 requirement of each species varies directly as the total metabolic rate of the species, and that the requirement of the individual within the species varies directly as the weight of the individual.

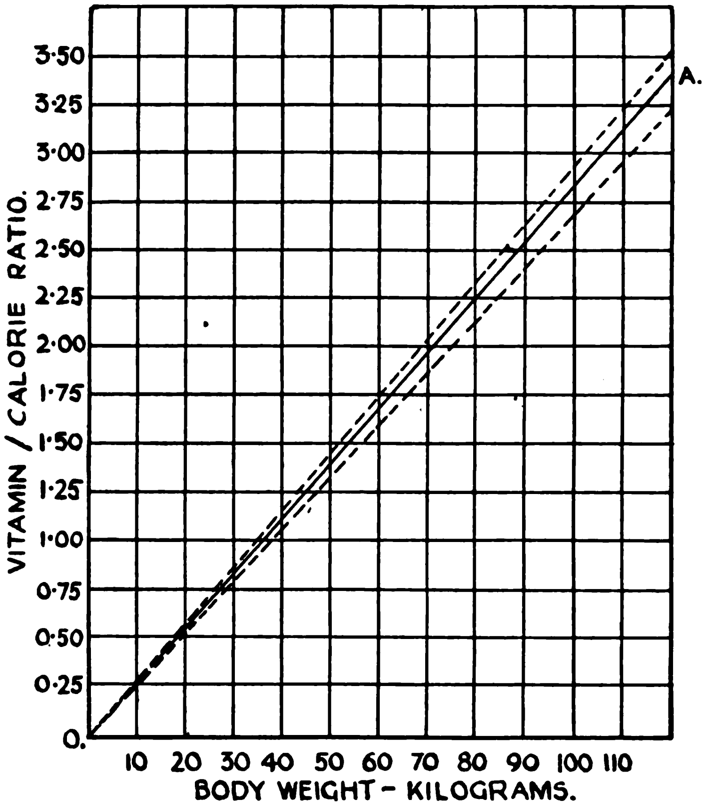
From these data he evolved formulæ from which he calculated the theoretical minimum vitamin B 1 requirement for the mouse, rat, dog and pigeon. Having confirmed the accuracy of these formulæ by testing them against diets for these animals, containing known amounts of vitamin B 1, he evolved a formula, based on human metabolism and body weight, which he considered would enable man's requirement of vitamin B 1 to be calculated.

His final step was to test the theoretical amount of vitamin B 1, as shown by this formula to be necessary to keep man in health, against the amounts of vitamin B 1 known to be contained in (*a*) human diets on which

beri-beri has been known to occur, and (*b*) human diets on which beri-beri had not occurred.

In applying his formula to these diets it was first necessary to calculate in a common unit the amount of vitamin B 1 in each. Unfortunately, although several observers have made assays of the amount of vitamin B 1 in various foodstuffs, each worker has adopted his own biological unit, so that no standard of comparison was available.

PREDICTION CHART.



O. A. = MINIMUM VITAMIN B.1. REQUIREMENT REFERRED TO BODY WEIGHT AS CALCULATED FROM COWGILL'S FORMULA.

Recently (1931) the League of Nations Health Organisation selected ten milligrammes of a specially prepared extract of rice polishings as their standard unit of vitamin B 1, and by comparing this unit with the various units of other workers Professor Cowgill was able to prepare a table of Index Values, based on the various assays for vitamin B 1 already in existence, giving, in terms of the milligram-equivalent of the vitamin B concentrate used in all his experiments, the vitamin B 1 content of all the required articles of food.

He then investigated 116 diets associated with outbreaks of beri-beri and obtained agreement with the theoretical values as indicated by his formula in 91·4 per cent, while with diets not associated with beri-beri he obtained agreement in 100 per cent.

To facilitate this investigation he constructed the preceding Prediction Chart which renders easy the determination of the adequacy, or inadequacy, of any diet in vitamin B 1.

To use the chart: The number of milligram-equivalents of vitamin B 1 per person contained in the diet (using Cowgill's Index Value table) is divided by the total metabolic rate per person for the twenty-four hours (this may be taken as the calorie value of the diet per person) and the number corresponding with the quotient is noted on the "Vitamin/Calorie Ratio" scale of the chart. If the plot of this number with the weight of the individual in kilograms falls definitely above OA the ration is adequate in vitamin B1. If the plot falls appreciably below this line the vitamin B1 requirement is not satisfied and beri-beri may be expected to occur should the period of subsistence on this diet be sufficiently prolonged. If the plot falls inside the dotted lines the diet may be considered as being borderline.

Professor Cowgill has set forth his facts clearly, logically and without bias; and his conclusions "(*a*) that the new formula states man's quantitative need for vitamin B with reasonable accuracy, and (*b*) that it is now possible to evaluate human dietaries with respect to their content of this important dietary essential" appear to be justified by the evidence he adduces. Certainly no one can controvert his modest claim that the results obtained in this study are "correct in the sense of a reasonable first approximation to the truth."

To these conclusions three important corollaries must be added: (1) That investigators of outbreaks of beri-beri have now a means of expressing their results in exactly comparable terms; (2) that those concerned in the construction of communal diets (for example, for a military campaign) have now a simple method of assessing the exact dietetic requirements necessary to prevent beri-beri; and (3) that the way is now pointed to a similar attack on the other vitamins. F. H.

THE CONDUCT AND FATE OF THE PERIPHERAL SEGMENT OF A DIVIDED NERVE IN THE CERVICAL REGION WHEN UNITED BY SUTURE TO THE CENTRAL SEGMENT OF ANOTHER DIVIDED NERVE. By Sir Charles Ballance, Consulting Surgeon to St. Thomas's Hospital. London: Macmillan and Co., Ltd. 1934. Pp. 45. Price 7s. 6d. net.

This small pamphlet of forty-five pages emanates from the research laboratories of the Royal College of Surgeons.

It is a detailed description of twelve experiments proving that so-called anastomosis does not eventuate in a living union of the essential elements of the two nerves.

The essence of these experiments is the utilization of the cervical sympathetic nerve anastomosed in various ways to other nerves so that the down growth of the axions can be definitely traced and differentiated.

For instance, in a suture union of the cervical sympathetic and hypyglossal nerves, the nerve at the final examination between the ligature and the tongue cannot be recognized as a hypoglossal nerve. Though sympathetic fibres have been substituted for hypoglossal fibres in the nerve between the site of suture and the tongue muscles, it appears to function in the same normal manner as its predecessor.

Each experiment is beautifully illustrated, including a diagram of the operation performed, and photomicrographs taken at considerable periods after the anastomosis operation. The difference in the types of the axions is very well seen.

Many other interesting points are brought out by the experiments, especially the regeneration of the end plates.

It is not clear if these experiments preceded or followed the work done by Sir Charles Ballance in conjunction with Dr. Arthur Baldwin Duel, in America, which showed the value of using degenerated nerve for grafting in facial palsy as detailed by Dr. Duel in his two lectures given at the Royal College of Surgeons of England on October 10 and 11, 1934.

The experiments described in this pamphlet are a model of clear presentation and completely convincing to the reader.

The printing and reproduction of the photomicrographs are excellent.

All who are interested in the subject of nerve anastomosis and regeneration should be in possession of a copy of this small work. J. W. W.

SYNOPSIS OF OBSTETRICS AND GYNÆCOLOGY. By Aleck W. Bourne, M.B., F.R.C.S. Bristol: John Wright and Sons. 1935. Pp. vii + 444. Price 15s.

The sixth edition of this work brings up to date a most valuable synopsis.

The whole field of problems that confronts the gynæcologist and obstetrician is covered in a most comprehensive manner.

Puerperal sepsis, its manifestations and degrees, prophylaxis and treatment are dealt with in the light of the investigations carried out during the last few years.

The chapter on obstetric surgery deals fully and clearly with the diagnosis and treatment of abnormal presentations and difficulties encountered during the course of labour.

Methods adopted for induction of abortion and labour are clearly described and their comparative value in relation to the duration of the pregnancy to be terminated.

The difficult subject of treatment for infective conditions of the uterine endometrium and cervix is brought up to date together with that of the menorrhagias caused by affections of the uterine musculature.

The present position of radium in the treatment of pelvic disease is outlined.

Last but not least the author discusses the causes and prophylaxis of obstetric shock and the treatment of this obscure but dangerous condition.

The synopsis has entirely succeeded in its purpose. It constitutes an invaluable guide and help to the practitioner of these subjects and should be in the possession of every gynæcologist.

CLINICAL METHODS. By Robert Hutchison, M.D.Edin., F.R.C.P.Lond., and Donald Hunter, M.D., F.R.C.P.Lond. Tenth Edition. London: Cassell and Co., Ltd. 1935. Pp. lxvi + 616. Price 12s. 6d.

First published in 1897 this manual has now been reprinted thirty-four times and this speaks for itself.

Thoroughly revised for each new edition the book retains its original form and size and the wonder is not that so many changes have been made in the text and figures but that so much of the book is still as it appeared on first issue, thus showing the sound basis on which it was planned in the beginning.

Through all these years it has remained a safe guide to the student and the clinician, and this last edition maintains the very high standard set by its predecessors in the value of the methods described and its essentially wise teaching.

Notices.

EIGHTH INTERNATIONAL CONGRESS OF MILITARY MEDICINE AND PHARMACY.

BRUSSELS, JUNE 27 TO JULY 3, 1935.

It has just been announced that Their Majesties the King and Queen of Belgium and Her Majesty the Queen Elizabeth have given their distinguished patronage to the Eighth International Congress of Military Medicine and Pharmacy.

By this gracious action the Sovereigns of Belgium show how much they are interested in military medical questions, continuing the tradition which made the Queen Elizabeth a symbolic figure of charity during the Great War, as was Florence Nightingale in the Crimean War, and also the tradition which caused King Albert to preside in person at the meeting of the First International Congress of Military Medicine and Pharmacy.

The First Congress was held at Brussels in 1921 on the initiative of the Medical Service of the Belgian Army. Since then the increasing success

of these international meetings has been apparent in the Congresses of Rome, Paris, London, Madrid, etc.

This year Belgium will be the intellectual meeting place of the world; it is therefore only natural that these great International Congresses, after an existence of fifteen years, should visit the capital where they were created.

The importance of the discussions, the attraction of the Universal and International Exhibition, and the elaborate programme are a sufficient guarantee of the success of the Eighth International Congress of Medicine and Pharmacy.

For further information application should be made to the General Secretary of the Eighth Congress of Military Medicine, Inspection Générale du Service de Santé, Abbage de la Cambre, Brussels.

ERGOMETRINE.

THE isolation of the new ergot alkaloid, Ergometrine, recently described by Dudley and Moir has been followed by the commercial issue of the drug by Burroughs Wellcome and Co.

Four preparations of the alkaloid are issued for therapeutic use: "Tabloid" Ergometrine, 0·5 milligramme, for oral administration; "Wellcome" Solution of Ergometrine, 0·5 milligramme in 2·5 cubic centimetres, for oral administration; "Tabloid" Hypodermic Ergometrine, 0·25 milligramme, for intramuscular injection; "Tabloid" Hypodermic Ergometrine, 0·05 milligramme, for intravenous administration.

The alkaloid used in these preparations is of a high degree of purity and crystallizes readily from a number of solvents as described in Dr. Dudley's later communication (*British Medical Journal*, April 13). Ergometrine is characterized by the rapidity with which it causes contraction of the uterus and is used clinically for this effect during the puerperium.

Ergometrine has a pronounced and more rapid action in a dosage smaller than that required in the case of ergotoxine. It is remarkably free from side effects.

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C.N. = Clinical and other Notes.
C.L. = Current Literature.

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